KENWOOD

SSB TRANSCEIVER

Model TS-820S

INSTRUCTION MANUAL

IMPORTANT

This manual has been written basically for use of model TS-820S. The difference between models TS-820S and TS-820 is that model TS-820S has digital display built-in as against model TS-820 has no digital display built-in. Accordingly, if you have purchased model TS-820, you may skip over the passages concerning digital display.

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TS-820S SPECIFICATION

FREQUENCY RANGE ..... 160 meter band — 1.80 to 2.00 MHz
80 meter band — 3.50 to 4.00 MHz
40 meter band — 7.00 to 7.30 MHz
20 meter band — 14.00 to 14.35 MHz
15 meter band — 21.00 to 21.45 MHz
10 meter band — 28.00 to 28.50 MHz (A)
10 meter band — 28.50 to 29.00 MHz (B)
10 meter band — 29.00 to 29.50 MHz (C)
10 meter band — 29.50 to 29.70 MHz (D)
WWV — 15.0 MHz (receive only)

MODE ..... USB, LSB, or CW, FSK

POWER REQUIREMENTS .....

	120/220 VAC, 50/60 Hz		13.8V DC operation	
	TS-820S	TS-820	TS-820S	TS-820
Receive	57 watts (heaters on) 38 watts (heaters off)	45 watts (heaters on) 26 watts (heaters off)	6A (heaters on) 1.4A (heaters off)	5A (heaters on) 0.6A (heaters off)
Transmit	292 watts (maximum)	280 watts (maximum)	16A (Maximum)	15A (maximum)

PLATE POWER INPUT .....

120/220 VAC, 50/60 Hz operation	13.8V DC operation
200 watts PEP for SSB operation	120 watts PEP for SSB operation
160 watts DC for CW operation	90 watts DC for CW operation
100 watts for FSK operation	60 watts for FSK operation

AUDIO INPUT IMPEDANCE ..... 50 k ohms (high impedance)

AUDIO OUTPUT IMPEDANCE ..... 4 to 16 ohms (speaker or headphones)

AUDIO OUTPUT ..... More than 1.5 watts (with less than 10% distortion) into an 8 ohm load.

RF OUTPUT IMPEDANCE ..... 50 ~ 75 ohms

FREQUENCY STABILITY ..... Within 100 Hz during any 30 minute period after warmup
Within ±1 kHz during the first hour after 1 minute of warmup

AUDIO FREQUENCY RESPONSE ..... 400 to 2600 Hz, within −6 db

CARRIER SUPPRESSION ..... Carrier better than 40 db down from the output signal

SIDEBAND SUPPRESSION ..... Unwanted sideband is better than 50 db down from the output signal

IMAGE RATIO ..... Image frequency better than 60 db down from the output signal

HARMONIC RADIATION ..... Better than 40 db down from output signal

SPURIOUS RADIATION ..... Better than 60 db down from output signal (without harmonic radiation)

IF REJECTION ..... IF frequency is 80 db or more down from output signal

RECEIVER SENSITIVITY ..... 0.25 μV S+N/N 10 db or more

RECEIVER SELECTIVITY ..... SSB: 2.4 kHz bandwidth (−6 db down)
4.2 kHz bandwidth (−60 db down)
CW*: 0.5 kHz bandwidth (−6 db down)
1.5 kHz bandwidth (−60 db down)
* (with optional CW filter installed)

TUBE AND SEMICONDUCTOR COMPLEMENT .....

	TS-820S	TS-820
Tubes	3	3
IC'S	38	5
FET'S	31	30
Transistors	95	74
Diodes	195	167

DIMENSIONS ..... 13-1/8 (333)wide × 6-0 (153)high × 13-3/16 (335)deep inch (mm)

WEIGHT ..... 35.2 lbs. (16 kg)

SECTION 1. FEATURES

1. PLL System, HF Band SSB/CW/RTTY Transceiver

This transceiver employs newly developed PLL (Phase Locked Loop) circuit, covering 1.8 to 29.7 MHz (WWV 15 MHz) for SSB, CW and RTTY operations.

2. Minimum Spurious and Excellent Overload and Crossmod. Characteristic

The adoption of FET balanced type mixer, MOS FET and single conversion system minimizes spurious during transmission and assures excellent overload and cross-mod. characteristic during reception.

3. Built-in IF SHIFT Circuit

IF SHIFT circuit is built in the transceiver to shift IF pass band without changing receive frequency. The circuit is also called the "pass band tuning circuit". It allows you to eliminate radio interference or set the receive frequency characteristic to the desired bandwidth simply by manipulating one control knob.

4. Built-in RF Processor

The unique speech processor uses a quick time constant at 455 kHz. Since this circuit is of RF type, it produces little distortion and, unlike the clipper system, does not deteriorate the tonal quality.

5. RF NFB

RF NFB from the transmit final stage to the driver stage improves the cross modulation distortion. The use of the amplification type ALC further improves the quality of transmit signals.

6. Newly Designed Analog Dial

The combination of newly designed mono-scale and sub-dial provides easy reading of frequencies. The adoption of a circuit that is completely free from changes in carrier frequencies permits accurate indication of frequencies on one dial pointer.

7. Digital Display Dial

The digital dial of TS-820S indicates transmit and receive frequencies using carrier, VFO and local oscillator signals instead of converting VFO frequencies. Thus, accurate frequencies can be read at all times at any band and any operating mode.

Since the accuracy of frequencies is set up only by the 10 MHz standard oscillator, frequencies can be read accurately up to 100 Hz order by calibrating the oscillator with WWV.

The green indication on the dial assures many hours of fatigueless operation.

8. D.H. (Display Hold) SWITCH

By pressing the D.H switch, the frequency read on the digital remains on, thus serving as a memory system.

9. Rigid Structure and Easy Operation

The transceiver is built with a die casting front panel and a rigid chassis, providing outstanding mechanical stability for mobile operation. All the operating parts such as control knobs and dials are designed and arranged according to human engineering technology to ensure maximum case of operation.

10. Monitor Circuit

The monitor circuit allows you to hear your own voice during transmission, which is normally impossible with conventional transceivers. This is very useful when checking the modulation condition or adjusting the RF processor.

11. Selector Switch for SSB/CW Receive Frequency Response

During CW reception the audio frequency response is automatically narrowed to improve the clarity of sound.

12. Build-in Fixed Channel Circuits with RIT (crystals are optional)

The fixed channel circuits with RIT permit the use with the built-in VFO for more enjoyable operation.

13. Transverter Connector

Transverter TV-502 (2m) can be connected for ready operation. Changeover to HF or VHF is accomplished automatically with the power switch of the transverter.

14. Built-in AC Power Supply, and DC Operation with Optional DC-DC Converter

DC-DC Converter DS-1A (option) can be attached to the transceiver for mobile operation.

15. Wide Variety of Auxiliary Circuits and Devices

The transceiver is completed with a noise blanker circuit, VOX circuit, side tone circuit, marker circuit, built-in speaker, 3-position AGC switch, heater switch, IF OUT terminal and linear terminal.

The following devices are available as optional extra: Remote VFO (VFO-820), CW Filter (YG-88C), Digital Display (DG-1A), Transverter (TV-502S), Microphone (MC-50), Low Pass Filter (LF-30A).

SECTION 2. INSTALLATION

2.1 UNPACKING

Remove the TS-820S from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the boxes and packing material and notify the transportation company immediately. It is a good idea to save the boxes and packing material in any case because they are very useful for shipping or moving the equipment.

The following accessories should be included with the transceiver:

1 Operating Manual
1 Microphone Plug
1 Jumpered 9-pin Plug (installed)
5 RCA Phono Plugs
1 Alignment Tool
2 Plastic Extension Feet with Screws
1 AC Power Cord
1 Speaker Plug
1 8P US Plug
4 Fuse (6A × 2, 4A × 2)

2.2 OPERATION LOCATION

As with any solid state electronic equipment the TS-820S should be kept from extremes of heat and humidity. Choose an operating location that is dry and cool, and avoid operating the transceiver in direct sunlight. Also, allow at least 3 inches clearance between the back of the equipment and any object. This space allows an adequate air flow from the ventilating fan to keep the transceiver cool.

2.3 POWER CONNECTIONS

Make sure the POWER switch on the front panel of the TS-820S is turned off, the stand-by switch is put in the REC position, and that the voltage switch on the back of the TS-820S is switched to the correct line voltage (120 or 220.) Connect the POWER cord to an appropriate external power source.

2.4 ANTENNA

Connect a 50 ~ 75 ohms antenna feedline to the coaxial connector on the rear panel.

Fixed Station — Any of the common antenna systems designed for use on the high frequency amateur bands may be used with the TS-820S, provided the input impedance of the transmission line is not outside the capability of the pi-output matching network. The transmission line should be of the coaxial cable type. An antenna system which shows a standing wave ratio of less than 2 : 1 when using 50 or 75 ohm coaxial transmission line, or a system that results in a transmission line input impedance that is essentially resistive, and between 15 and 200 ohms will take power from the transceiver with little difficulty. If openwire or balanced type transmission line is used with the antenna, a suitable antenna tuner is recommended between the transceiver and the feed line. Methods of construction and operating such tuners are described in detail in the ARRL Antenna Handbook, and similar publications. For operation on 75 and 40 meter bands, a simple dipole antenna, cut to resonance in the most used portion of the bands, will perform satisfactorily. For operation of the transceiver on the 10, 15, and 20 meter bands, the efficiency of the station will be greatly increased if a good directional rotary antenna is used. Remember that even the most powerful transceiver is useless without a proper antenna.

Mobile Station — Mobile antenna installations are critical, since any mobile antenna for use on the high frequency bands represents a number of compromises. Many amateurs lose the efficiency of their antenna through improper tuning. Remember the following points when using the TS-820S with a mobile antenna.

The "Q" of the antenna loading coil should be as high as possible. There are several commercial models available which use high "Q" coils.

The loading coil must be capable of handling the power of the transceiver without overheating. In the CW mode the power output of the transceiver will exceed 80 watts.

The SWR bridge is a useful instrument, but unfortunately it is quite often misunderstood, and overrated in importance. Basically, the SWR bridge will indicate how closely the antenna load impedance matches the transmission line. With long transmission lines, such as will be used in many fixed station installations, it is desirable to keep the impedance match fairly close in order to limit power loss. This is particularly true at the higher frequencies. The longer the line, and the higher the frequency, the more important SWR becomes. However, in mobile installations the transmission line seldom exceeds 20 feet in length, and an SWR of even 4 to 1 adds very little power loss. The only time SWR will indicate a low figure is when the antenna presents a load close the 50 ohms, but many mobile antennas will have a base impedance as low as 15 or 20 ohms at their resonant frequency. In such a case, SWR will indicate 3 or 4 to 1, and yet the system will be radiating efficiently.

The really important factor in your mobile antenna is that is should be carefully tuned to resonance at the desired frequency. The fallacy in using an SWR bridge lies in the fact that it is sometimes possible to reduce the SWR reading by detuning the antenna. Field strength may actually be reduced in an effort to bring SWR down. Since field strength is the primary goal, we recommend a field strength meter for antenna tuning.

For antenna adjustments, the transceiver may be loaded lightly, using the TUN position instead of operating at full power output. This will limit tube dissipation during adjustments, and will also help to reduce interference on the frequency. In any case, do not leave the transmitter on for very long at one time. Turn it on just long enough to tune and load, and get a field strength reading. Start out with the antenna whip at about the center of its adjustment range. Set the VFO to the desired operating frequency and then adjust the PLATE control for a dip, and then the LOAD control. Then observe the field strength reading. The field strength meter may be set on top of the dash, on the hood, or at an elevated location some distance from the car.

Change the whip length a half inch, or so at a time, retune the finals each time, and again check the field strength at the antenna. Continue this procedure until the point of maximum field strength is found. This adjustment will be most critical on 75 meters, somewhat less critical on 40, until on 10 meters the adjustment will be quite broad. After tuning the antenna to resonance, the finals can be loaded to full power.

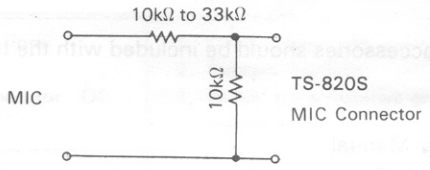
2.5 MICROPHONE

Attach the microphone connector to a suitable microphone as shown in Figure 2. Be sure that the PTT switch of the microphone is separate from the microphone circuit, as shown in Figure 3.
It should be noted that a microphone with a 3P plug having a common earth terminal cannot be used.

The microphone input is designed for high impedance (50k ohms) microphones only. The choice of microphone is important for good speech quality, and should be given serious consideration. The crystal lattice filter in the transceiver provides all the restriction necessary on audio response, and further restriction in the microphone is not required. It is more important to have a microphone with a smooth, flat response throughout the speech range.

The microphone manufacture's instructions should be followed in connecting the microphone cable to the plug. With many microphones, the push-to-talk button must be pressed to make the microphone operative. For PTT operation, this feature may be disabled, if desired, by opening the microphone case and permanently connecting the contacts which control the microphone.

The standard microphone sensitivity is within the range of −50 dB to −60 dB. If a microphone having a higher sensitivity is used, the ALC circuit will not function properly. In this case, insert an attenuator as shown in the illustration at right or connect a resistor (10k ~ 33k ohms) in parallel with the capacitor 100 pF (C94) in the IF unit (X48-1150-00) of the transceiver.



2.6 KEY

If CW operation is desired, connect a key to the KEY jack.

2.7 EXTERNAL SPEAKER AND HEADPHONES

Receive audio output from the TS-820S is 1.5 watt at 4 to 16 ohms. The TS-820S has a built-in speaker. However, if an external speaker is desired for fixed station or mobile operation, simply connect it to the SPEAKER jack on the real panel. The speaker may be any good 8 ohm permanent magnet type in the 4 inch or large size. The internal speaker is disconnected when an external speaker is used.
Headphones should also be 8 ohms impedance. When the headphones are connected to the front panel PHONES jack the speaker is disabled.

2.8 RTTY (FSK)

For RTTY operation, connect a teletypewriter to the RTTY KEY jack on the rear of the transceiver. Since this jack is connected to the switching circuit for shifting frequencies, a relay should be inserted in the closed loop of the teletypewriter for keying operation.

2.9 GROUND

So preventing to receive an electric shock, TVI and BCI, select a good, effective ground for installation and then connect an earthing wire to the backside of GND terminal. Use a heavy earth line as big as possible, it is because short-line wiring is regarded as most effective for operation.

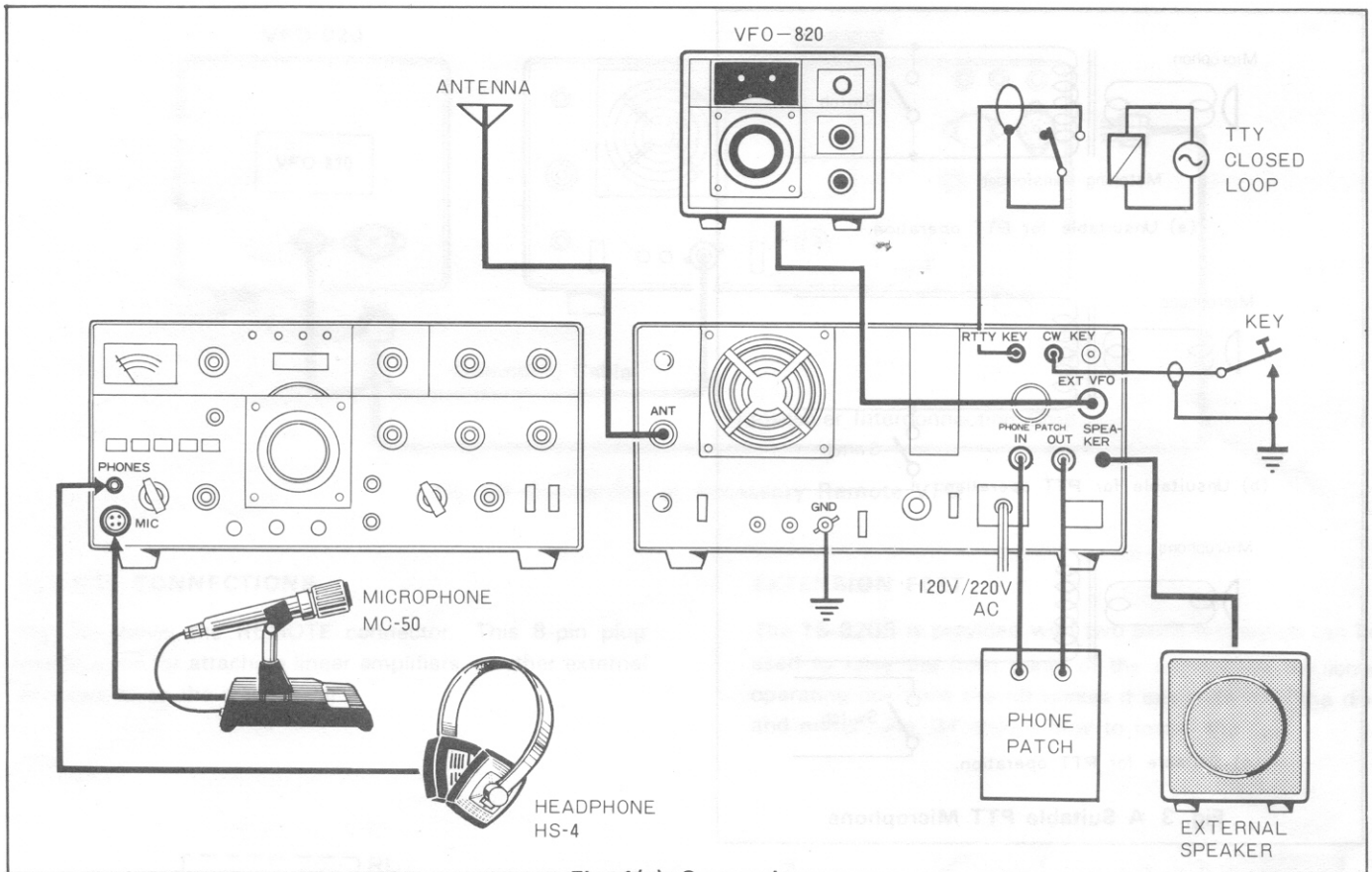
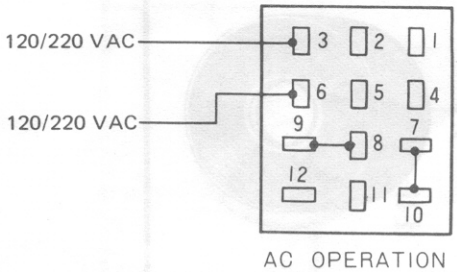
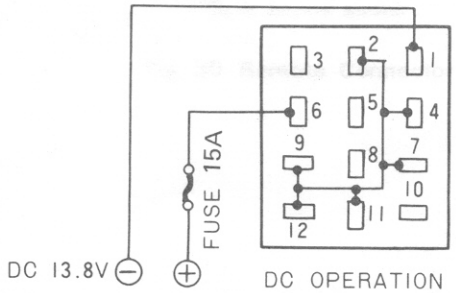


Fig. 1(a) Connection

IMPORTANT-When wiring a new power plug, confirm that the pin numbering on the new plug is identical to the pin numbering on the POWER connector. The transceiver can be damaged by incorrect pin wiring.

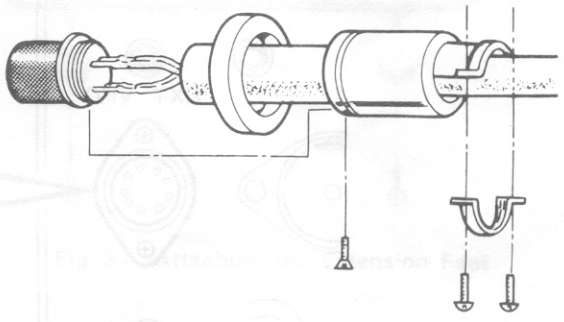


AC OPERATION



DC OPERATION

Fig. 1(b) Power Plug Wiring



seen from the cord.

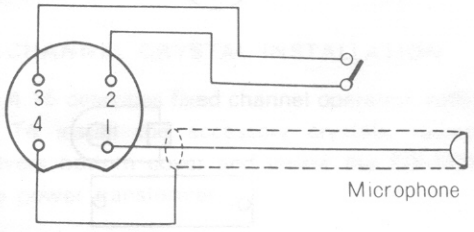


Fig. 2 Microphone Connection Wiring

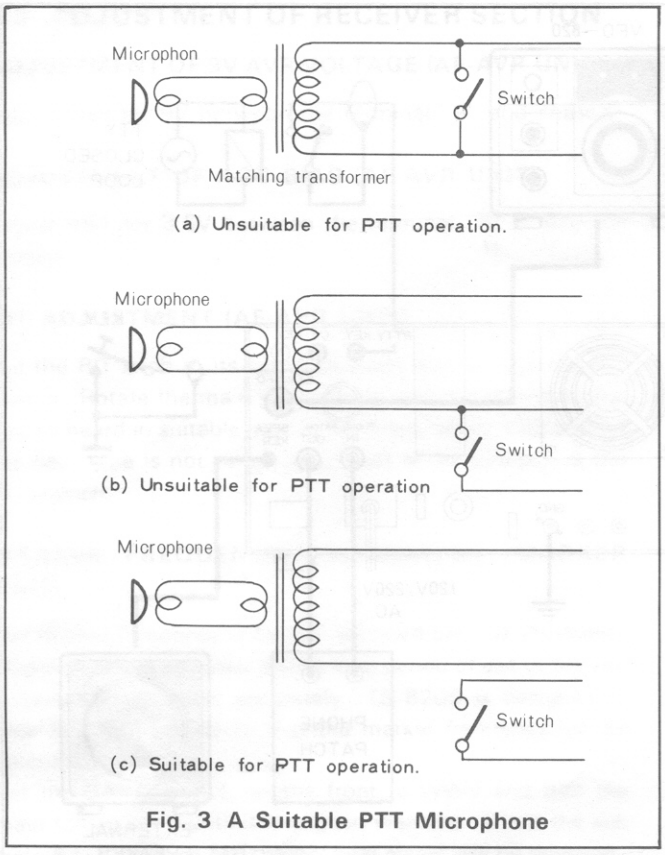


Fig. 3 A Suitable PTT Microphone

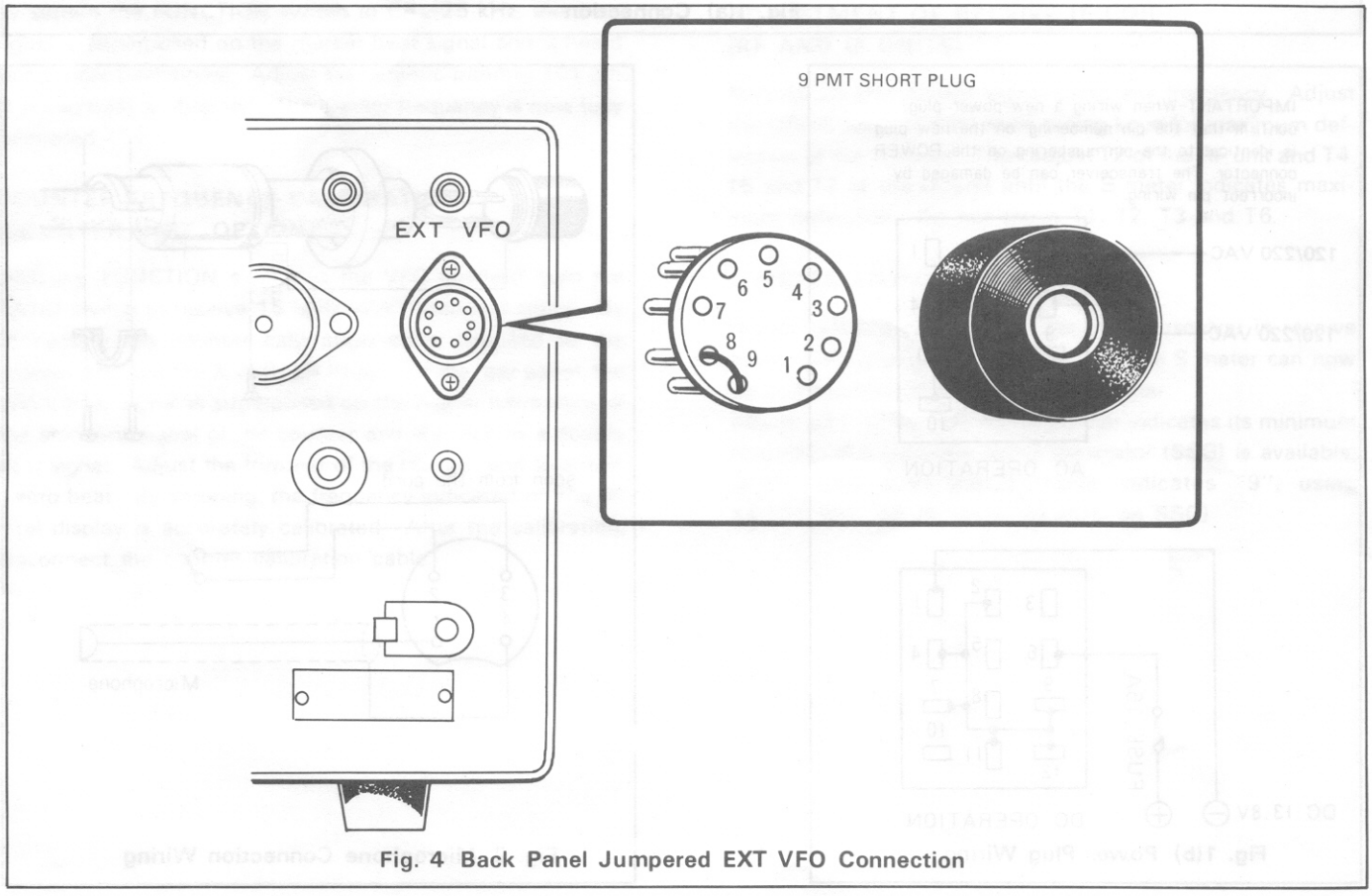
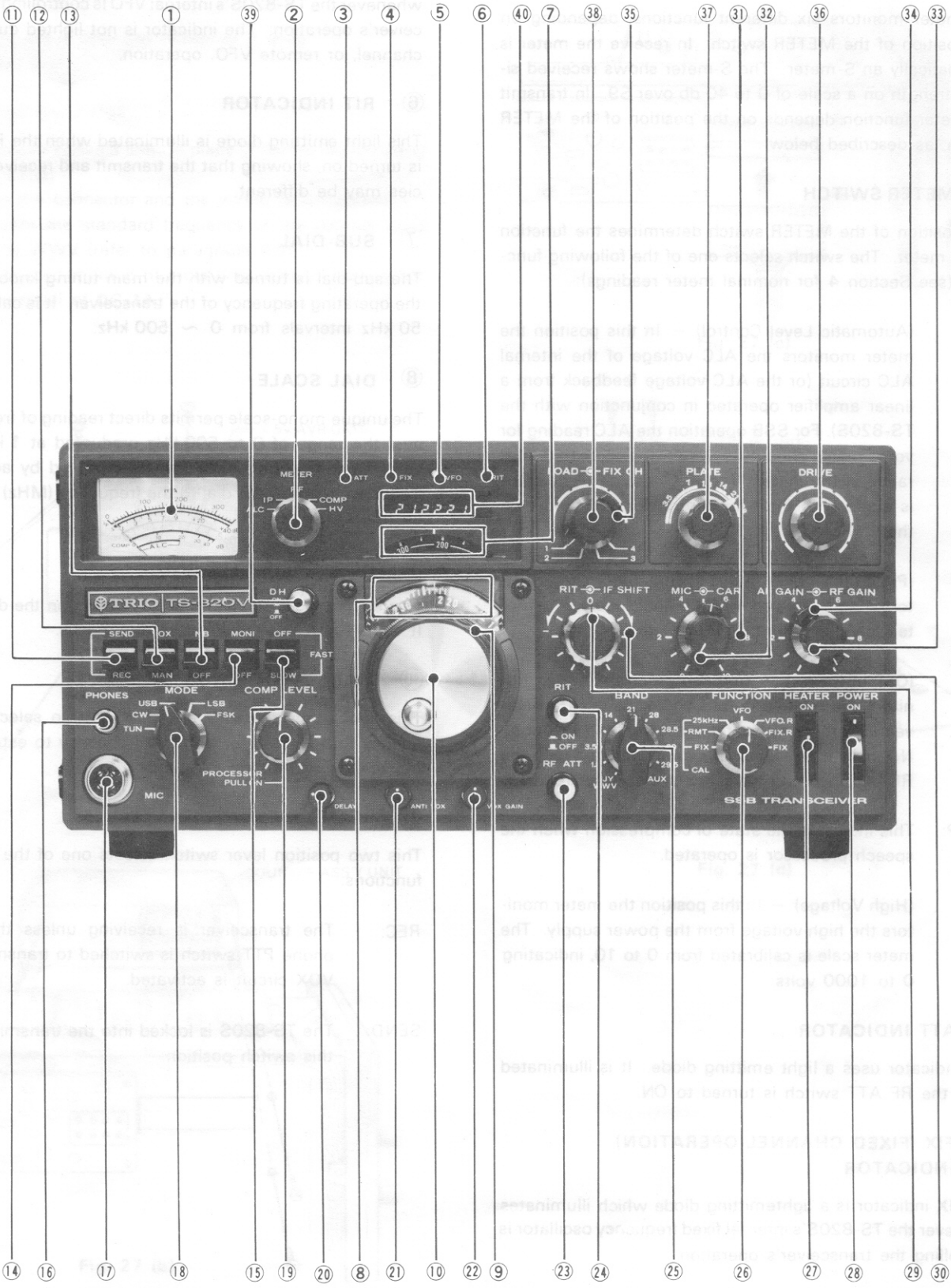


Fig. 4 Back Panel Jumpered EXT VFO Connection

SECTION 3. OPERATING CONTROLS

Front View Panel



3.1 FRONT PANEL CONTROLS

① METER

The meter monitors six different functions, depending on the position of the METER switch. In receive the meter is automatically an S-meter. The S-meter shows received signal strength on a scale of 0 to 40 db over S9. In transmit the meter function depends on the position of the METER switch, as described below.

② METER SWITCH

The position of the METER switch determines the function of the meter. The switch selects one of the following functions (see Section 4 for nominal meter readings):

ALC (Automatic Level Control) — In this position the meter monitors the ALC voltage of the internal ALC circuit (or the ALC voltage feedback from a linear amplifier operated in conjunction with the TS-820S). For SSB operation the ALC reading for voice peaks should be within the indicated ALC range of the meter. The ALC voltage adjustment is made with the MIC control for SSB and with the CAR control for CW.

IP (Plate Current) — In this position the meter monitors the plate current of the final tubes. The meter scale is calibrated from 0 to 350 ma.

RF: (Output Power) — In this position the meter monitors the relative output power of the transceiver. There is no meter scale for this position. Normally the reading should be adjusted with the RF VOLT control for a 2/3 scale meter reading.

COMP: This indicates the state of compression when the speech processor is operated.

HV: (High Voltage) — In this position the meter monitors the high voltage from the power supply. The meter scale is calibrated from 0 to 10, indicating 0 to 1000 volts.

③ ATT INDICATOR

This indicator uses a light emitting diode. It is illuminated when the RF ATT switch is turned to ON.

④ FIX (FIXED CHANNEL OPERATION) INDICATOR

The FIX indicator is a lightemitting diode which illuminates whenever the TS-820S's internal fixed frequency oscillator is controlling the transceiver's operation.

⑤ VFO INDICATOR

The VFO indicator is a light emitting diode which illuminates whenever the TS-820S's internal VFO is controlling the transceiver's operation. The indicator is not lighted during fixed channel, or remote VFO, operation.

⑥ RIT INDICATOR

This light emitting diode is illuminated when the RIT circuit is turned on, showing that the transmit and receive frequencies may be different.

⑦ SUB-DIAL

The sub-dial is turned with the main tuning knob to select the operating frequency of the transceiver. It is calibrated at 50 kHz intervals from 0 ~ 500 kHz.

⑧ DIAL SCALE

The unique mono-scale permits direct reading of frequencies over the range of 0 to 500 kHz graduated at 1 kHz intervals. Operating frequency can be obtained by adding the frequency read on the dial to the frequency (MHz) indicated on the BAND switch.

⑨ DIAL CALIBRATE KNOB

This knob is used to calibrate the reading on the dial scale. It should not be used for tuning purposes.

⑩ MAIN TUNIG KNOB

This knob turns the VFO and dial scale to select the frequency to be added to the band frequency to establish the transceiver's operating frequency.

⑪ STAND-BY SWITCH

This two position lever switch selects one of the following functions:

REC: The transceiver is receiving unless the microphone PTT switch is switched to transmit, or the VOX circuit is activated.

SEND: The TS-820S is locked into the transmit mode in this switch position.

⑫ VOX SWITCH

This two-position lever switch selects one of the following functions.

MAN: With the switch in this position, the transceiver is switched into transmit or receive by the stand-by switch or the PTT switch on the microphone.

VOX: With the switch in this position, the VOX circuit is turned on for voice operated transmit on SSB semi-automatic break-in operation on CW.

⑬ NB SWITCH

The NB switch turns the built-in noise blanker circuit on and off. The noise blanker is designed to reduce pulsating ignition type noises. When the lever switch is flipped up, the circuit is turned on.

⑭ MONI (MONITOR) SWITCH

This switch is used to demodulate part of the output of the transmit IF amplifier for monitoring transmit signals.

⑮ AGC SWITCH

The AGC switch controls the AGC (Automatic Gain Control) circuit giving the operator three choices:

OFF: It may be desirable to turn the AGC off when receiving a very weak signal.

FAST: The FAST AGC position is designed for use in CW operation.

SLOW: Use the SLOW AGC position for SSB operation.

⑯ PHONES JACK

The headphones jack allows use of a 4 to 16 ohm set of headphones with a 1/4" phone plug attached. When the phones are plugged into the transceiver, the speaker is disconnected.

⑰ MIC CONNECTOR

The microphone connector is four pronged, allowing use of the PTT microphone. Figure 2 shows how to wire the plug on the microphone cable.

⑱ MODE SWITCH

The MODE switch is used for selection of type of waves or for TUNE operation.

TUN: Used for adjustment of transmit conditions. The input power to the final stage is low as compared with that for CW so that the final stage tubes can be protected against damage due to overloading during adjustment. Since the KEY circuit is inoperative in the TUN mode, the transceiver cannot be used for transmission or reception.

CW: Used for CW operation.

USB: Used for USB operation. It is internationally determined that the 14, 21 and 28 MHz bands belong to USB.

LSB: Used for LSB operation. It is internationally determined that the 3.5 and 7 MHz bands belong to LSB.

FSK: For RTTY operation with teletypewriter.

⑲ COMP LEVEL KNOB

Pull this knob during SSB operation. The speech processor is activated and the talk-power is increased. Adjust the state of compression by turning the knob while observing the COMP meter.

⑳ DELAY KNOB

The DELAY control adjusts the holding time of the VOX circuit for VOX or break-in CW operation. The control will have to be adjusted to the preference of the individual operator.

㉑ ANTI VOX KNOB

This control adjusts the level of the anti VOX signal fed in to the VOX circuit. Adjust the control to prevent feedback of the speaker from tripping the VOX circuit.

㉒ VOX GAIN KNOB

This control adjusts the sensitivity of the VOX circuit by adjusting the gain of the VOX amplifier, for voice controlled operation.

㉓ RF ATT SWITCH

With this switch set to ON, ATT (attenuator) of about 20 dB is connected to the antenna circuit, protecting the RF amplifier and mixer circuit from strong input signals.

㉔ RIT SWITCH

This is the switch for the RIT (receiver incremental tuning) circuit. To turn on the circuit, press this switch; to turn off, press it once again. The RIT indicator is illuminated when

the RIT circuit is ON. By turning the RIT knob, the receive frequency of VFO can be changed by ±3 kHz and the frequency of fixed channel by ±150 Hz without changing the transmit frequency.

㉕ BAND SWITCH

This 11-position switch selects all the necessary circuits to tune the transceiver to the desired 500 kHz band.

㉖ FUNCTION SWITCH

This 7-position rotary switch selects one of the following transceive functions.

CAL-FIX: This position allows calibration of the TS-820S's internal VFO to one of the transceiver's fixed frequency channels (if an optional fixed channel crystal is installed). With the switch in this position a signal is generated at the selected fixed channel frequency and the main tuning knob can be tuned to zero beat the calibrating signal.

CAL-RMT: This position allows calibration of the VFO-820 (remote VFO) to the transceiver's operating frequency. With the switch in this position, the transceiver generates a calibrating signal and the VFO-820 can be tuned to zero-beat the calibrating signal.

CAL-25 kHz: With the switch in this position, the transceiver's calibrator circuit generates a marker signal at every 25 kHz for normal calibration of the internal VFO.

VFO: The switch is kept in this position for normal transceive operation.

VFO.R: With the switch in this position, the TS-820S's internal VFO controls the receive function and the internal fixed channel oscillator controls the transmit function (if fixed channel crystals are installed in the oscillator).

FIX.R: With the switch in this position, the TS-820S's internal VFO controls the transmit function and the built-in fixed channel oscillator controls the receive function (if fixed channel crystals are installed in the oscillator). The VFO.R and FIX.R allow cross-channel operation without an external VFO.

FIX: With the switch in this position, the TS-820S's fixed channel oscillator controls the transmit and receive function of the transceiver (if accessory fixed channel crystals are installed in the transceiver).

㉗ H. SW (HEATER) SWITCH

This switch turns the heater circuits of the three transmitting tubes on and off. The heaters would normally be turned to OFF to reduce power consumption in mobile or portable receiving.

㉘ POWER SWITCH

The POWER switch turns all the power on and off in the TS-820S.

㉙ RIT KNOB

This knob is used to change receive frequency when the RIT circuit is in operation. Set the center position (0) of the RIT knob to the RIT-OFF.

㉚ IF SHIFT KNOB

By using this knob during reception, the center frequency of the IF crystal filter can be shifted by ±1.7 kHz, facilitating the adjustment of the tonal quality of receive signal or eliminating radio interference from nearby frequencies. For normal operation, this knob should be set to the center position (click is heard).

㉛ MIC GAIN KNOB

This knob is used for adjustment of the gain of MIC amplifier during SSB operation. Adjust so that the meter pointer does not deflect beyond the ALC zone.

㉜ CAR (CARRIER) LEVEL KNOB

Used to adjust carrier level during CW operation. Adjust so that the meter does not deflect beyond the ALC zone.

㉝ AF GAIN KNOB

This knob adjusts the gain of the receiving audio amplifier. The audio volume of the received signal increases as the control is turned clockwise.

㉞ RF GAIN KNOB

This control adjusts the gain of the receiver section's RF amplifier. Turn the knob fully clockwise for maximum gain and for a correct S-meter reading. Turn the control counter--clockwise to reduce the gain.

㉟ FIX CH (FIXED CHANNEL) SELECT SWITCH

This four-position rotary switch selects between four different fixed frequency channels which can be installed inside

the transceiver. Fixed frequency operation is convenient for operation on often used frequencies. The fixed channel oscillator replaces the VFO when the FUNCTION switch is placed in the FIX position.

㊱ DRIVE KNOB

The DRIVE tuning control tunes the plate tank circuit of the 12BY7A driver as well as receiver's antenna and mixer coils. In receive the DRIVE control is tuned for maximum sensitivity (maximum S-meter deflection). In transmit the DRIVE control is tuned for a maximum ALC reading. When the control is correctly tuned for transmission it will be correctly tuned for reception.

㊲ PLATE KNOB

The PLATE control adjusts the plate tuning of the two final amplifier tubes.

㊳ LOAD KNOB

The LOAD control adjusts the loading of the pi-circuit between the final section and the antenna. The control is adjust as described in Section 4 for impedance matching.

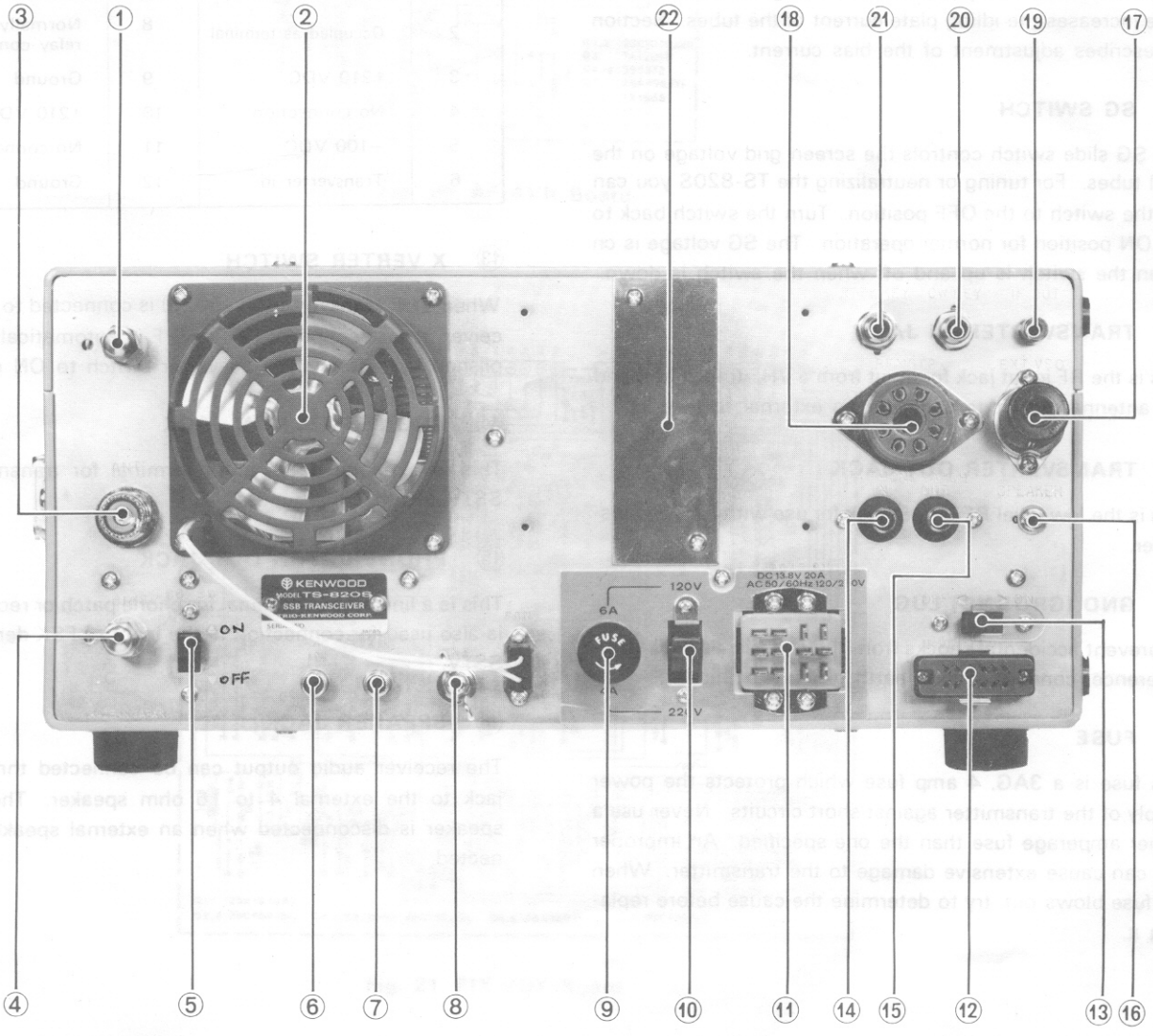
㊴ DH (DISPLAY HOLD) SWITCH

With this switch set to ON, the frequency below 100 kHz on the display dial remains on even when the main dial knob is rotated. This feature is useful to memorize the original frequency when checking other frequencies. The DH switch being ON turns off the lights for "MHz" frequencies, eliminating a worry about mis-reading frequencies.

㊵ DIGITAL DISPLAY UNIT

The digital display unit indicates operating frequencies to the figures of 100 Hz.
With the option DG-1A, the same unit will easily be installed to model TS-820, too.

Rear Panel View



3.2 REAR PANEL CONTROLS

① RF VOLT

Use the RF VOLT control to adjust the sensitivity of the RF output function of the meter. Adjust it for a 2/3 scale reading during CW transmission.

② COOLING FAN

This fan cools the RF amplifier section of the TS-820S to insure reliable and efficient operation.

③ ANTENNA CONNECTOR

This SO-239 coax connector should be attached to a suitable antenna for transmitting and receiving. See Section 2.4 for a discussion of an appropriate antenna.

④ BIAS CONTROL

The BIAS control adjusts the bias voltage of the two S2001A (6146B) amplifier tubes. Tuning the control clockwise increases the idling plate current of the tubes. Section 4 describes adjustment of the bias current.

⑤ SG SWITCH

The SG slide switch controls the screen grid voltage on the final tubes. For tuning or neutralizing the TS-820S you can set the switch to the OFF position. Turn the switch back to the ON position for normal operation. The SG voltage is on when the switch is up and off when the switch is down.

⑥ TRANSVERTER IN JACK

This is the RF input jack for input from a VHF transverter and the antenna output terminal for an external receiver.

⑦ TRANSVERTER OUT JACK

This is the low level RF output jack for use with a VHF transverter.

⑧ GND (GROUND) LUG

To prevent accidental shocks from the chassis, as well as interference, connect a good earth ground to this lug.

⑨ FUSE

This fuse is a 3AG, 4 amp fuse which protects the power supply of the transmitter against short circuits. Never use a higher amperage fuse than the one specified. An improper one can cause extensive damage to the transmitter. When the fuse blows out, try to determine the cause before replacing it.

When the position of the AC Voltage Selector Switch is changed, it is also necessary to change the power fuse. For 120 volt operation a 6 ampere fuse, for 220 volt operation a 4 ampere fuse provided with the TS-820S should be used.

⑩ AC VOLTAGE SELECT SWITCH

This slide switch switches the primary of the power transformer to select 120 or 220 VAC operation.

⑪ POWER SUPPLY CONNECTOR

This 12-pin connector is used to connect an AC or DC power source to the transceiver.

⑫ TRANSVERTER CONNECTOR

This 12-pin connector is used to control an accessory VHF transverter.

PIN	FUNCTION	PIN	FUNCTION
1	ALC	7	Transverter in
2	Occupied as terminal	8	Normally closed relay contact
3	+210 VDC	9	Ground
4	No connection	10	+210 VDC
5	−100 VDC	11	No connection
6	Transverter in	12	Ground

⑬ X VERTER SWITCH

When VHF Transverter (TV-502S) is connected to the transceiver, the selection of HF or VHF is automatically accomplished by setting the transverter switch to ON or OFF.

⑭ PHONE PATCH IN JACK

This is a phone patch input terminal for transmission of SSTV or other line inputs.

⑮ PHONE PATCH OUT JACK

This is a line output terminal for phone patch or recording. It is also used for connection to the input of FSK demodulator SSTV.

⑯ SPEAKER JACK

The receiver audio output can be connected through this jack to the external 4 to 16 ohm speaker. The internal speaker is disconnected when an external speaker is connected.

⑰ EXTERNAL VFO CONNECTOR

This 9-pin connector provides a means of interconnecting the KENWOOD VFO-820, another external VFO, or an external receiver. The interconnecting cable is provided with the VFO-820. The 9-pin jumpered VFO plug provided with the TS-820S must be inserted in this socket for normal transceiver operation.

PIN	FUNCTION	PIN	FUNCTION
1	VFO signal	6	Calibrator signal (9 VDC)
2	VFO signal shield	7	No connection
3	Ground	8	9 VDC to internal VFO (pin 9)
4	12.6 VAC	9	9 VDC to external VFO
5	Relay voltage (+ on transmit)		

⑱ REMOTE CONNECTOR

The REMOTE connector is an 8-pin socket for use in interconnecting a linear amplifier, an external speaker, or another accessory item. (See Fig. 30)

PIN	FUNCTION	PIN	FUNCTION
1	Ground	5	Normally open relay contact
2	No connection	6	ALC-freeback ALC threshold level approx. −6V
3	Normally closed relay contact	7	Occupied as terminal
4	Ground	8	External speaker Load impedance 4 ~ 16Ω

⑲ IF OUT JACK

Receive signals from the final IF stage are supplied to this jack for monitoring waveforms of opposite stations.

Frequency 8.83 MHz
Output Approx. 0.67 Vrms. (ANT input more than 3μV, load resistance 4.7 kΩ)

⑳ CW KEY JACK

Connect a key to this 1/4″ phone jack for CW operation. Key opened terminal voltage approx. −65V.

㉑ RTTY KEY JACK

This is used for FSK operation. A 2P plug should be inserted for connection to the switching circuit of a teletypewriter.

㉒ DC-DC CONVERTER CONNECTING HOLE

DC-DC Converter (DS-1A, option) can be wired through this hole. For wiring, remove the cover plate.

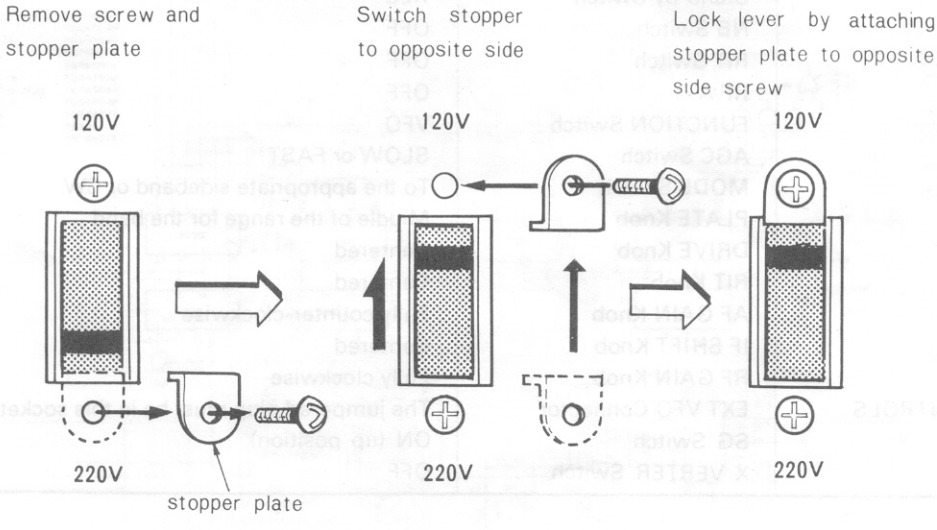


Fig. 5 Changing Power Voltage from 220V to 120V

SECTION 4. OPERATING INSTRUCTIONS

4.1 PRELIMINARY PROCEDURE

Set the MIC and CAR controls to zero and the MODE switch to LSB, USB, or CW to prevent accidental transmit conditions before tuning. The TS-820S must be operated into a 50 ~ 75 ohm antenna or dummy load with an SWR less than 2 : 1. Random length wire antennas or light-bulb dummy loads cannot be used. Conventional half-wave dipoles and beam antennas should only be used at or near their resonant frequency. Exceeding an SWR of 2 : 1 can damage the components in the output stage of the transceiver.

Be sure to complete all of the required cabling, as described in Section 2.3 ~ 2.8.

With a suitable antenna and microphone (or key) connected to the transceiver, set the TS-820S switches to positions described in Table 1.

4.2 RECEIVER TUNING

Refer to Table 1 for the initial switch settings of the TS-820S for receiving, and then continue with the described procedure.

Push the POWER switch on. The meter, dial scale, and VFO indicator will light, indicating that the transceiver is operating. The receiver section is fully solid-state allowing reception with the H. SW switch turned to OFF. Advance the AF GAIN control clockwise until some receiver noise is heard in the speaker. Turn the main tuning dial within the frequency range of the amateur band chosen until a signal is heard. Tune the signal for the clearest possible reception, and then adjust the DRIVE control for maximum deflection of the S-meter.

The RF GAIN control varies the AGC feedback voltage which effects the S-meter reading. With the RF GAIN control fully clockwise, the S-meter gives a proper signal strength reading. Tuning the control counter-clockwise reduces the RF GAIN, reducing signal strength and band noise.

4.3 READING THE OPERATING FREQUENCY

The TS-820's tuning dial represents exact carrier frequencies regardless of operating modes and directly indicates the transmission and reception frequencies except for the CW transmission mode in which the real transmission frequency is approx. 800 Hz higher than the dial readout which indicates the BFO frequency. In this CW transmission mode,

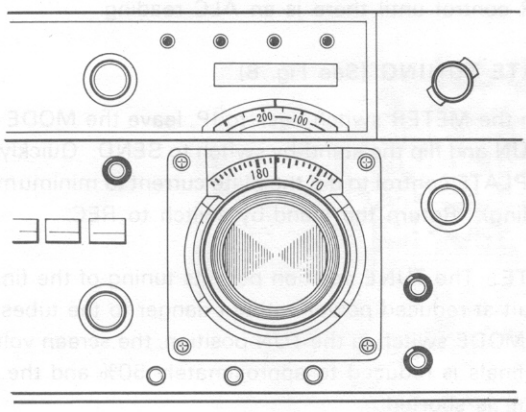
TABLE 1. Initial Switch Settings for Receiving

CONTROL LOCATION	CONTROL	POSITION
FRONT PANEL CONTROLS	BAND Switch	Desired band
	POWER Switch	OFF
	H. SW Switch	OFF
	Stand-by Switch	REC
	NB Switch	OFF
	RIT Switch	OFF
	RF ATT	OFF
	FUNCTION Switch	VFO
	AGC Switch	SLOW or FAST
	MODE Switch	To the appropriate sideband or CW
	PLATE Knob	Middle of the range for the band
	DRIVE Knob	Centered
	RIT Knob	Centered
	AF GAIN Knob	Fully counter-clockwise
	IF SHIFT Knob	Centered
	RF GAIN Knob	Fully clockwise
REAR PANEL CONTROLS	EXT VFO Connector	The jumpered plug must be in this socket
	SG Switch	ON (up position)
	X VERTER Switch	OFF

The remaining controls do not affect reception so they may be in any position.

however, the digital frequency readout gives the real transmission frequency. In the FSK mode as well, the tuning dial indicates a transmission frequency (space) of approx. 2.2 kHz higher than the real transmission frequency whereas the digital readout gives the real frequency.
When there is any difference between the tuning dial readout and the digital readout, calibrate the tuning dial readout to the digital readout by means of the Calibration knob.

NOTE: When the digital display is used, the digits for 10 MHz order change according to the BAND switch and are independent of the counter unit. In the 29.5 MHz band, for example, the indication "29.999.9" is followed by "20.000.0".



Dial Reading: 177 kHz
The operating frequency of the transceiver is the sum of the band frequency and dial reading frequency.
Example: Band switch 14 MHz
Operating Frequency: 14000 + 177 = 14177 kHz

Fig. 6 Reading the Operating Frequency

4.4 CALIBRATING THE FREQUENCIES

FOR THE MODEL TS-820 (without the counter)

To read frequencies correctly from the dial scale, the dial must be calibrated previously using a 25 kHz marker. To calibrate, set the FUNCTION switch to CAL-25 kHz and the RIT switch to OFF. Turning the RF ATT switch to ON reduces the incoming signal and the marker signal can be received more easily. Detailed method of calibration is described below.

SSB

Set the MODE switch to USB or LSB. Marker signals are received at every 25 kHz so accurate calibration is possible over the entire range of the dial.

With the transceiver set to your desired band, turn the main tuning knob so that a beat signal can be received at every 25 kHz. Turning this knob further will cause the beat signal to vary from high to low tone and finally become a zero beat. Accurate zero beat point is obtained by turning the IF SHIFT knob in the "—" direction (for USB), and in the "+" direction (for LSB). Stop turning the knob at the zero beat point and rotate the dial calibrate knob alone while holding the main tuning knob until the dial pointer indicates 0, 25, 50 or 75 on the dial.
The dial calibrate ring is coupled to the Main Tuning knob by a spring slip clutch permitting easy rotation. For the Model TS-820 having a counter, set the tuning dial to the frequency given in the digital readout.

CALIBRATING THE FIXED CHANNEL AND VFO FREQUENCIES

Fixed channel and VFO frequencies can be calibrated at the CAL-FIX position of the FUNCTION switch. Set the switch to the CAL-FIX position and turn the VFO main tuning knob until a beat signal is received in the vicinity of fixed channel frequency. Calibration is effected at the zero beat position.

CALIBRATING THE TS-820S WITH VFO-820

Turn the FUNCTION switch to CAL-RMT to calibrate the TS-820S with the VFO-820, a receiver, or another remote VFO. Tune the remote VFO to the frequency selected on the TS-820S and zero beat the generated marker signal. At zero beat, the TS-820S and remote VFO frequencies coincide.

By calibrating the TS-820S for normal operation, as described previously, the TS-820S can be used as a frequency standard for calibrating the remote VFO.

4.5 RF GAIN

RF GAIN is controlled by changing the voltage of the AGC circuit. Adjust the RF GAIN knob so that the S meter does not cause excessive deflection. This minimizes the noise during reception and allows the S meter to indicate the correct signal strength. For normal operation, this knob should be turned fully clockwise for maximum sensitivity.

4.6 RF ATT

If the transceiver is operated in a short-distance (within several hundred meters) and strong signals of nearby frequencies are received, the wanted signals are blocked. Also, if the wanted signals are very strong, the S meter is scaled out. In this instance, set the ATT switch to ON. The input signals to the RF amplifier are attenuated by about 20 dB, providing distortionless reception.

4.7 RIT

By using the RIT knob, the receive frequency of VFO can be shifted by about ±3 kHz and the frequency of fixed channel by about ±150 Hz without changing the transmit frequency. If the frequency of the opposite station is deviated, your receive frequency can be set to the station by turning the RIT switch to ON and using the RIT knob. The state of RIT can be checked bh the indicator in the window of the dial.

4.8 IF SHIFT

By using the IF SHIFT knob during reception, the pass band frequency of the crystal filter can be shifted by about ±1.7 kHz because of adoption of PLL (Phase Locked Loop) circuit in the local oscillator circuit. This is one of the major features of TS-820S and can be used in the following cases:

1. Adjustment of Tonal Quality and Interference Rejection during SSB Reception.

   When the transceiver is used in USB mode, turn the IF SHIFT knob in the "+" direction and the lower frequencies are cut out. Turning the knob in the "—" direction cuts out the higher frequencies (these procedures are reversed for LSB mode). Adjust the knob so that the tonal quality suits your listening preference. The IF SHIFT knob is also effective in eliminating interference when the receive signals are superposed on nearby signals.
2. Adjustment of Tonal Quality during CW Operation

   For detailed descriptions, refer to Section 4.13 "CW operation".
3. FSK (RTTY) Operation at 850 Hz Shift

   For detailed descriptions, refer to Section 4.19 "RTTY operation".

4.9 NOISE BLANKER

The TS-820S has a sophisticated built-in noise blanker designed to reduce ingition type impulse noise. The noise blanker is particularly important for mobile operation. When necessary, activate the noise blanker circuit by flipping the NB switch up.

4.10 AGC (AUTOMATIC GAIN CONTROL)

Set the AGC switch to the position appropriate for the received signal. Generally for SSB reception set the AGC switch to SLOW, for CW reception set the AGC switch to FAST, and for reception of a very weak signal the switch may be set to OFF.

4.11 TRANSMITTER TUNING

Connect the TS-820S to a 50 ohm dummy load or a 50 ohm antenna with an SWR of less than 2 : 1 before making any transmitter adjustments. The life of the final tubes is directly related to the SWR of the antenna and to the length of tuning periods.

Refer to Table 2 for the initial switch settings of the TS-820S for transmitting. Tune the main tuning knob to the desired operating frequency.

PLATE IDLING CURRENT (See Fig. 7)

Turn the main tuning knob to the desired operating frequency within the amateur band selected. Flip the stand-by switch to SEND and check that the plate current (IP) is 60 ma. If the plate current is not correct, adjust the rear panel BIAS control for a correct 60 ma of idling current and return the stand-by switch to REC.

CAUTION: If the plate current is very much higher than 60 ma do not leave the stand-by switch on for more than a few seconds. Excessive plate current shortens the life of the final tubes.

DRIVE TUNING (See Fig. 8)

Shift the METER switch to ALC and the MODE switch to TUN and peak the ALC reading (maximum meter deflection) with the DRIVE control. The stand-by switch is in the SEND position for adjustment.

NOTE: If there is no ALC reading indicated, increase the CAR control until there is an ALC reading.

PLATE TUNING (See Fig. 8)

Turn the METER switch back to IP, leave the MODE switch at TUN and flip the stand-by switch to SEND. Quickly adjust the PLATE control to dip the plate current (a minimum meter reading). Return the stand-by switch to REC.

NOTE: The TUNE position permits tuning of the final tank circuit at reduced power without danger to the tubes. With the MODE switch in the TUN position, the screen voltage of the finals is reduced to approximately 50% and the keying circuit is shorted.

PLATE AND LOAD TUNING

CAUTION: When the MODE switch is in the CW position the final tubes draw full plate current in transmit. Final tube life is directly related to the length of tune-up periods. Do not transmit with the tubes out of resonance for more than 10 seconds at a time.

Turn the MODE switch to CW, turn the METER switch to RF, and set the stand-by switch to the SEND position. Quickly adjust the PLATE control and then the LOAD control alternately to peak (maximum meter deflection) the power output. If necessary, adjust the RF VOLT control on the rear panel to bring the output reading to about a 2/3 scale reading.

NOTE 1: The ALC meter is less deflected at the ON position of the SG switch or at the CW position of the MODE switch than at the OFF position or the TUN position of these switches. This indicates the normal state of RF NFB. The MIC knob and the CAR knob should be properly adjusted under normal transmit conditions.

NOTE 2: Transmission is not effected at the WWV or AUX position of the BAND switch. If the transceiver is left in the transmit mode over a few minutes, the driver tube 12BY7A of the final stage may be damaged.

Table 2. Initial Switch Settings for Transmission

(The controls not described should be set as described in Table 1)

LOCATION	CONTROL	POSITION
FRONT PANEL CONTROLS	BAND Switch	Desired band
	POWER Switch	ON
	H. SW Switch	ON
	Stand-by Switch	REC
	MODE Switch	USB or LSB depending on selected band
	VOX Switch	MAN
	MONI Switch	OFF
	MIC Control	Fully counter-clockwise
	CAR Control	Centered
	METER Switch	Ip
	PLATE Control	Middle of the range for the band
	DRIVE Control	Centered
	FUNCTION Switch	VFO
	RIT Switch	OFF
REAR PANEL CONTROLS	SG Switch	UP (ON)
	EXT VFO Connector	Jumpered plug inserted

TABLE 3. Summery of Transmitter Tuning Procedures

MODE Switch	METER Switch	Stand-by Switch	Procedure
USB or LSB	IP	SEND	Adjust BIAS control for 60 ma.
TUN	ALC	SEND	Peak the ALC reading with the DRIVE control.
TUN	IP	SNED	Dip plate current with PLATE control.
CW	RF	SEND	Peak RF output by alternately adjusting the PLATE AND LOAD controls.

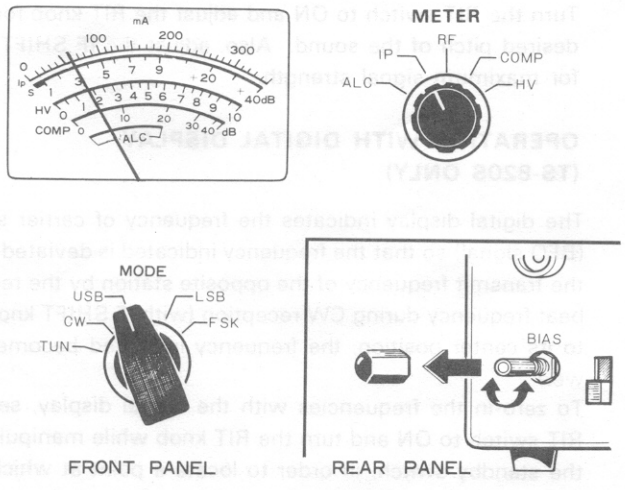


Fig. 7 Adjustment of the Plate Idling Current

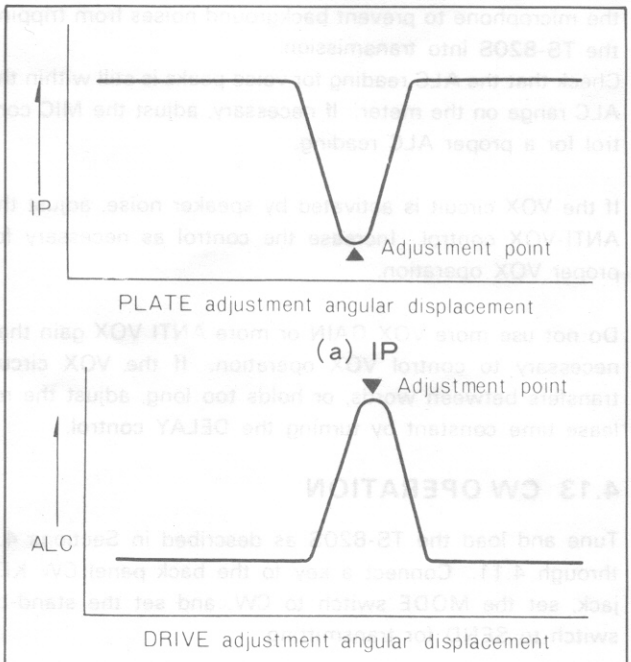


Fig. 8 Plate and Drive Tuning

4.12 SSB OPERATION

Tune the TS-820S as described in Sections 4.1 to 4.11. Set the MODE switch to USB or LSB and connect a microphone to the MIC connector.

NOTE: International amateur practice dictates using USB or LSB on the following bands.

3.5 MHz Band	LSB
7.0 MHz Band	LSB
14.0 MHz Band	USB
21.0 MHz Band	USB
28.0 MHz Band	USB

Key the transmitter and speak into the microphone with the tone of voice used in normal operation. Adjust the MIC control until voice peaks are just within the top limit of the ALC range printed on the meter scale. The METER switch is in the ALC position. If the transmitter section is driven beyond this range, the transmitted signal will be distorted.

PTT OPERATION

By connecting the microphone equipped with PTT switch, the transceiver is readily used for PTT operation. For communication, depress PTT switch with STANDBY switch left in the REC position.

VOX OPERATION

Adjust the transceiver as described in the previous paragraph. Flip the VOX switch on and close-talk into the microphone, increasing the VOX GAIN control until the VOX relay just operates. For VOX operation it is desirable to close-talk the microphone to prevent background noises from tripping the TS-820S into transmission.
Check that the ALC reading for voice peaks is still within the ALC range on the meter. If necessary, adjust the MIC control for a proper ALC reading.

If the VOX circuit is activated by speaker noise, adjust the ANTI-VOX control. Increase the control as necessary for proper VOX operation.

Do not use more VOX GAIN or more ANTI VOX gain than necessary to control VOX operation. If the VOX circuit transfers between words, or holds too long, adjust the release time constant by turning the DELAY control.

4.13 CW OPERATION

Tune and load the TS-820S as described in Sections 4.1 through 4.11. Connect a key to the back panel CW KEY jack, set the MODE switch to CW, and set the stand-by switch to SEND for transmitting.

CW transmissions are automatically monitored through the speaker of the transceiver. The audio gain of the sidetone can be adjusted with VR3 on the AF board.

For semi-break-in operation, turn the VOX switch on. Hold the key down and increase the VOX GAIN control, until the VOX relay just operates. It is desired to change the release time constant of the VOX circuit, adjust the DELAY control.

The plate current for CW operation should be about 200 ma. Use the CAR control to adjust the carrier level for CW operation. At 200 ma of IP there may be no ALC reading.

OPERATION WITHOUT CW FILTER

Set the IF SHIFT knob to its center position and the RIT switch to the OFF position to receive CW signal. Turn the main tuning knob for about 800 Hz of beat signal and your transmit frequency will be set to the transmit frequency of the opposite station (zeroing). During reception, the side tone monitor is activated by pressing down the key. In this case, listen to the side tone signal and the receive signal and adjust the main tuning knob so that the cycle of the sound is increased. By so doing, the zeroing of frequencies can be achieved. After zeroing, set the RIT switch to ON and turn the RIT knob for the pitch that suits your listening taste.
When interference is encountered, turn the IF SHIFT knob and the interference can be eliminated. For more effective CW operation, use the CW filter YG-88C (option) by referring to page 34.

OPERATION WITH CW FILTER (OPTION)

Set the transceiver in the receive mode by setting the IF SHIFT knob to the center position and the RIT switch to the OFF position. Adjust the main tuning knob for maximum deflection of the S meter. The pitch of the sound of the receive signal will now be about 800 Hz, indicating that the zeroing is completed.
Turn the RIT switch to ON and adjust the RIT knob for your desired pitch of the sound. Also, adjust the IF SHIFT knob for maximum signal strength.

OPERATION WITH DIGITAL DISPLAY (TS-820S ONLY)

The digital display indicates the frequency of carrier signal (BFO signal) so that the frequency indicated is deviated from the transmit frequency of the opposite station by the receive beat frequency during CW reception (with IF SHIFT knob set to its center position, the frequency indicated becomes lower).
To zero-in the frequencies with the digital display, set the RIT switch to ON and turn the RIT knob while manipulating the standby switch, in order to locate a point at which the frequency indicated is not changed regardless of the position of the stand-by switch. With the RIT knob left in that position, turn the main tuning knob until the signal from the

opposite station becomes a zero beat signal (zero beat signal can be easily noted by turning IF SHIFT knob).
This completes the zeroing of the transmit frequency. Turn the RIT knob for your desired pitch of sound.

TABLE 4. Meter Switch Positions for Different Modes

MODE	METER Switch	Approx. Readings
TUN	* ALC or	Peaked
	* IP or	75 ma
	* RF or	1/3 scale
	HV	800 v
CW	ALC or	None or within ALC range
	* IP or	200 ma
	RF or	2/3 scale
	HV	750 v
USB or LSB	* ALC or	Within the ALC range on voice peaks
	IP or	60 to 250 ma
	RF or	0 to 2/3 scale
	HV	800 v

* Recommended monitoring position during operation.

4.14 OPERATION WITH A LINEAR AMPLIFIER (See Fig. 30)

Tune and load the TS-820S as described in Sections 4.1 through 4.11 and adjust it for the selected mode.

The REMOTE connector on the back panel is provided for interconnections with an amplifier. See the instruction manual of the amplifier to determine whether the linear requires a normally open (during receive) or a normally closed (during receive) relay contact. Connect either pin 3 (normally closed to ground during receive) or pin 5 (normally open to ground during receive) of the REMOTE connector to the control jack on the amplifier.
Connect the ALC feedback from the amplifier to pin 6 of the REMOTE connector. The output of the TS-820S is quite adequate to drive most amplifiers to full rated output.

4.15 FIXED FREQUENCY OPERATION

The TS-820S has a built-in crystal controlled oscillator for fixed frequency operation. This feature is most useful for commonly used frequencies, nets, or any situation where crystal controlled operation is required. To use the fixed frequency oscillator, turn the FUNCTION switch to the FIX position. Select one of the four available channels with the fixed channel selector switch and tune and load the TS-820S as described in Sections 4.1 through 4.11. Simply operate the transceiver as described in Sections 4.12 and 4.13.

The crystal frequency is determined by the following formulas.

Crystal Frequency (MHz) = 5.5 MHz + X − Operating Frequency (MHz)

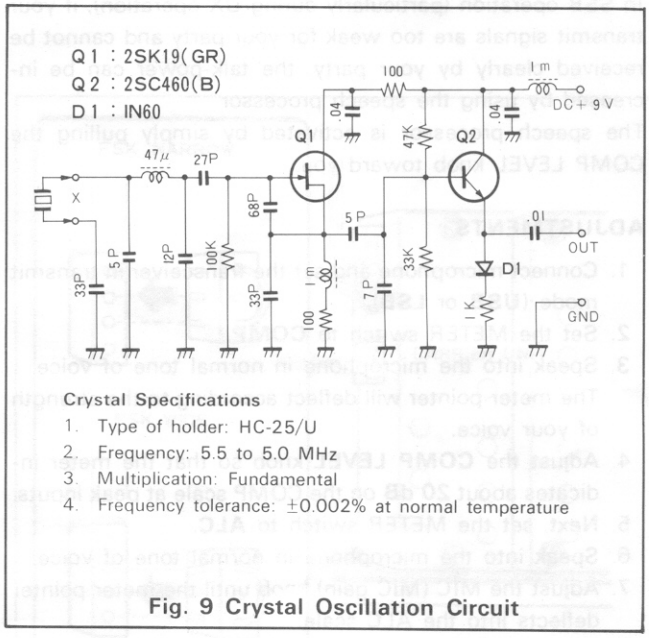
X = 1.8 for the 160 meter band
X = 3.5 for the 80 meter band
X = 7.0 for the 40 meter band
X = 14.0 for the 20 meter band
X = 21.0 for the 15 meter band
X = 28.0 for the 10 meter band or
X = 28.5 for the 10 meter band or
X = 29.0 for the 10 meter band or
X = 29.5 for the 10 meter band

Crystal Specifications: HC-25/U holder, 5.0 to 5.5 MHz oscillation frequency, and see Figure 9 for type of oscillation circuit.

Example: Desired Operating Frequency = 7.255 MHz
Crystal Frequency = 5.5 MHz + 7.0 MHz −
7.255 MHz = 5.245 MHz

This same crystal will operate on each band.
Operating Frequency = 5.5 MHz + X (in MHz) −
Crystal Frequency (in MHz)

Example: Crystal Frequency = 5.245 MHz
On the 14 MHz band the crystal will oscillate at
Operating Frequency = 5.5 MHz + 14.0 −
5.245 MHz
= 14.255 MHz



Crystal Specifications
1. Type of holder: HC-25/U
2. Frequency: 5.5 to 5.0 MHz
3. Multiplication: Fundamental
4. Frequency tolerance: ±0.002% at normal temperature

Fig. 9 Crystal Oscillation Circuit

4.16 INTERNAL CROSS CHANNEL OPERATION

The TS-820S contains a unique design feature which allows cross channel operation without a separate external VFO. The TS-820S's internal VFO is used together with the fixed frequency oscillaltor to allow reception and transmission on different frequencies. The fixed channel oscillator must have one or more accessory crystals installed for this feature to work.

FUNCTION SWITCH	TRANSMIT CONTROL	RECEIVE CONTROL
VFO	VFO	VFO
VFO.R	Fixed channel oscillator	VFO
FIX.R	VFO	Fixed channel oscillator
FIX	Fixed channel oscillator	Fixed channel oscillator

4.17 MOBILE OPERATION

The compact size and solid-state design of the TS-820S make it ideal for mobile use, by using optional DS-1A.
Be sure to use a mobile antenna which meets the requirements described in Section 2.

The normal operating procedures, described previously, apply to mobile operation. The noise blaker should be used to reduce ignition and impulse noises for clear reception. Remember that during transmission the transceiver draws about 15 amps so be careful not to drain the car's battery.

4.18 DX OPERATION (Use of PROCESSOR)

In SSB operation (particularly during DX operation), if your transmit signals are too weak for your party and cannot be received clearly by your party, the talk-power can be increased by using the speech processor.
The speech processor is activated by simply pulling the COMP LEVEL knob toward you.

ADJUSTMENTS

1. Connect microphone and set the transceiver in transmit mode (**USB** or **LSB**).
2. Set the METER switch to **COMP**.
3. Speak into the microphone in normal tone of voice. The meter pointer will deflect according to the strength of your voice.
4. Adjust the **COMP LEVEL** knob so that the meter indicates about **20 dB** on the COMP scale at peak inputs.
5. Next, set the METER switch to **ALC**.
6. Speak into the microphone in normal tone of voice.
7. Adjust the MIC (MIC gain) knob until the meter pointer deflects into the ALC scale.

OPERATING PRINCIPLE

The speech processor is inserted between the first and second stages of the microphone amplifier as shown in Fig. (A). The MIC gain control is used to adjust the B.M. input level.

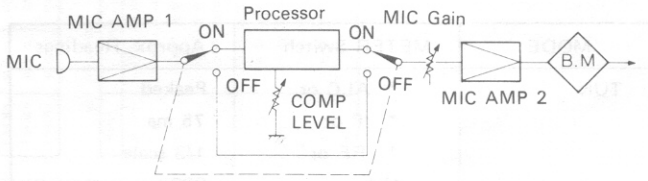


Fig. (A)

OPERATING CHARACTERISTIC

The speech processor functions so that the output of the MIC AMP 2 is maintained constant when the MIC input level exceeds −65 dB, as shown in Fig. (B). It also functions so that the output remains unchanged when the processor is set to ON and OFF at −40 dB of MIC input level.
The COMP LEVEL knob is used to adjust the compression level. It does not adjust the output of the microphone amplifier.

MICROPHONE SENSITIVITY

For proper function of the speech processor, the range of microphone input sensitivity is limited. The TS-820 is factory adjusted to operate the processor at the input sensitivity of MC-50 (see Note below).
If the sensitivity of your microphone is higher (e.g. −30 dB) than MC-50, the output of the MIC AMP 2 is decreased when the processor is set to ON. See Fig. (B).

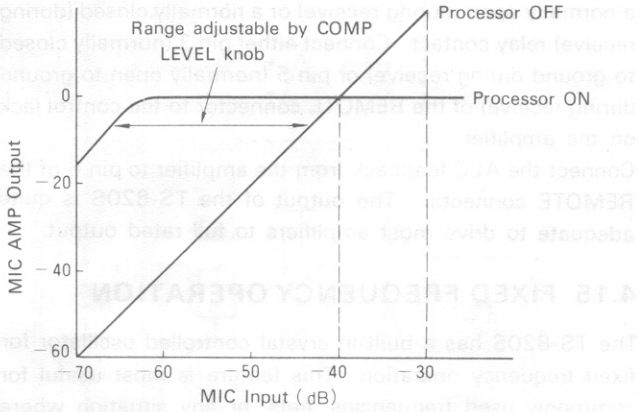


Fig. (B)

In this case, insert an attenuator as illustrated on page 6 and adjust the MIC input to the proper level.

NOTE: MC-50: Sensitivity to be −55 dB ±3 dB at about 5 cm from microphone.

4.19 RTTY OPERATION

For RTTY operation, the use of demodulator and teletypewriter is essential. The demodulator should be designed to operate from audio inputs and equipped with a filter for 2125/2295 Hz (NARROW, 170 Hz shift) or 2125/2975 Hz (WIDE, 850 Hz shift).

To key-in the FSK circuit of TS-820S, insert a relay coil into the closed loop circuit of teletypewriter and connect the relay contact to the RTTY KEY jack on the rear panel. Fig. 10 shows the relationship between the transmit and receive frequencies of TS-820S.

The frequency shift of the FSK circuit is preset at the factory to NARROW but it can be changed to WIDE by inserting the connector as shown in Fig. 11. When operating at the WIDE position, turn the IF SHIFT knob in the "—" direction by about 1.2 kHz so that the mark and space signals are well balanced during reception. If a CW filter (option) is used for NARROW operation, change the position of the connector of the IF unit (refer to "Operation with CW Filter").

Setting the MODE switch to FSK automatically decreases the input power of the final stage, permitting a long time of continuous operation.

4.20 SSTV (SLOW SCAN TV) OPERATION

SSTV operation can be accomplished by simply connecting the output of SSTV camera to the PHONE PATCH IN jack (or MIC connector) and the input of SSTV monitor to the PHONE PATCH OUT jack (or SPEAKER jack).

When transmitting signals from the SSTV camera, adjust its output so that the input power of the final stage is less than 100W (less than 125 mA Ip).

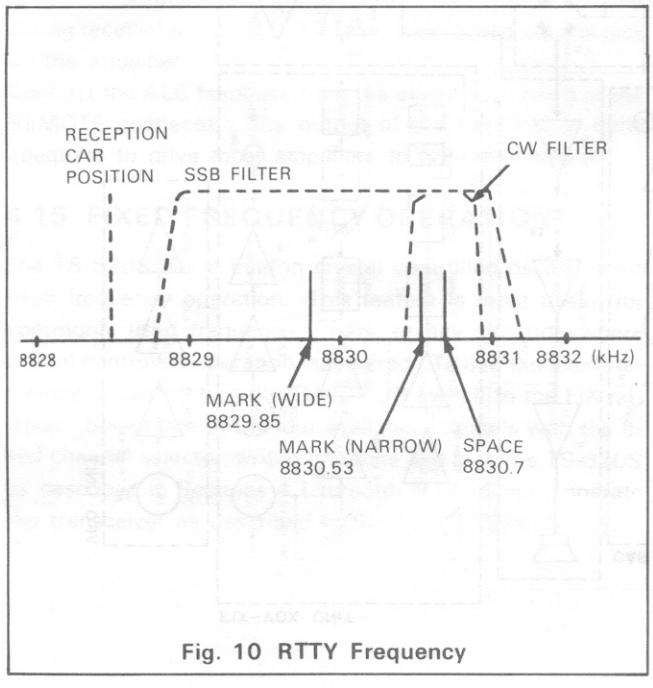


Fig. 10 RTTY Frequency

4.21 OPERATION WITH A PHONE PATCH

The TS-820S has rear panel jacks to facilitate using the TS-820S with a phone patch. The PHONE PATCH OUT jack has an impedance of 4 ~ 16 ohms and the PHONE PATCH IN jack requires a high impedance input. See the instruction sheet of the phone patch for cabling instructions.

4.22 USE OF MONITOR SWITCH

To monitor the quality of transmit signal during SSB operation, set the MONITOR switch to ON to demodulate part of transmit IF signal.

This feature is useful when checking modulation conditions or adjusting the RF speech processor.

When monitoring, use a headphone to avoid howling effect. Note that if the H. SW switch is OFF or the DRIVE knob is incorrectly adjusted, the ALC circuit does not operate properly, causing the level of transmit IF signal to become extremely high which results is distortion in the signal being monitored.

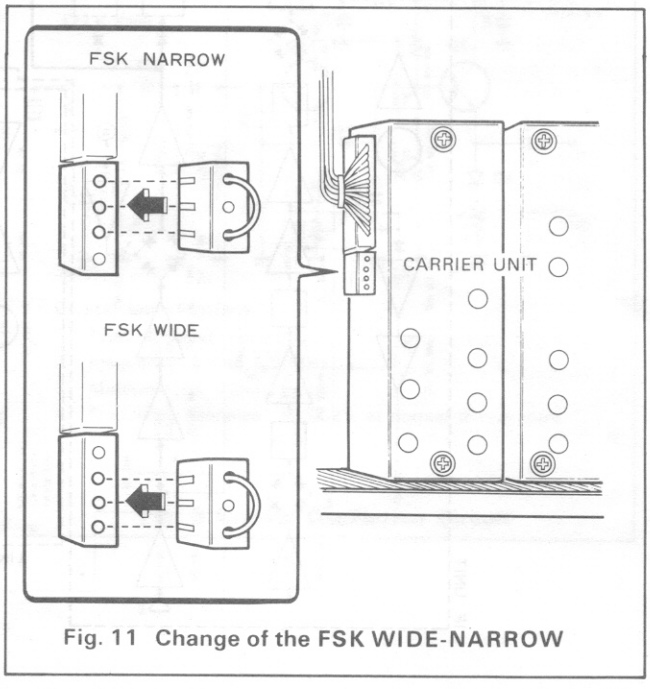
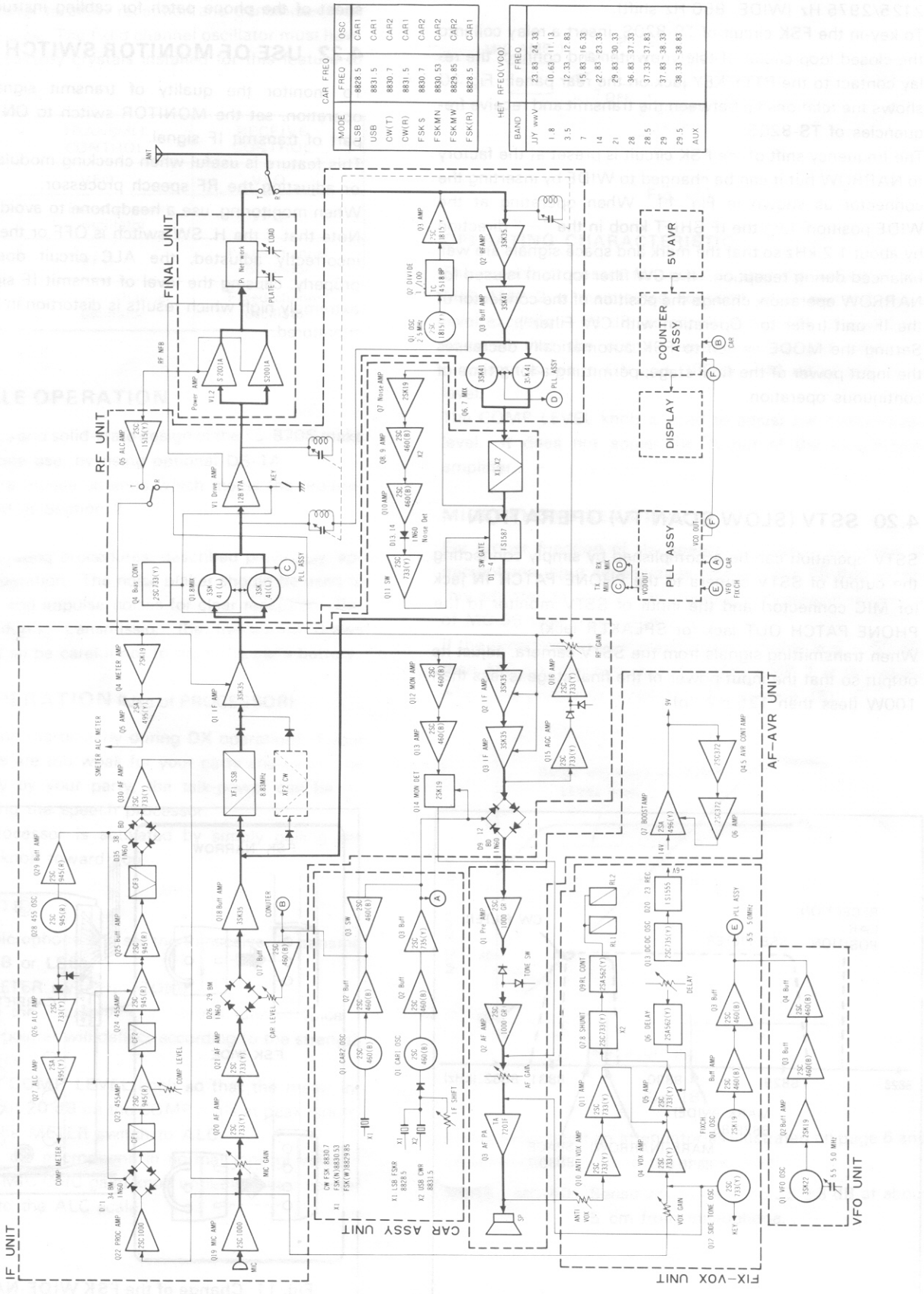


Fig. 11 Change of the FSK WIDE-NARROW

TS-820S BLOCK DIAGRAM



SECTION 5. CIRCUIT DESCRIPTON

5.1 BLOCK DIAGRAM

GENERAL

The block diagram of TS-820S is shown on page 24.

The transceiver is composed of the single superheterodyne receiver and the single conversion type transmitter with a filter type SSB generator. It uses 8,830 kHz IF and its local oscillator is equipped with a PLL (phase locked loop) circuit controlled by VFO. Both the receiver and transmitter use balanced type mixer circuits with dual gate MOS FET's, thus minimizing spurious during transmission and preventing the effects of strong signals and suprious signals during reception.

Taking full advantage of PLL system, the transceiver offers IF SHIFT function (electronic system pass band tuning) and permit one SSB filter to provide the same effect obtained by USB and LSB filters. The transceiver also includes a number of latest accessory circuits such as the RF speech processor, the digital display circuit, transmit monitor circuit, etc.

TRANSMITTER SECTION

The microphone signal is fed to the IF unit, amplified by the microphone amplifier and is then fed to the ring modulator composed of 4 diodes. The DSB output from the modulator passes through buffer amplifier and the crystal filter. The SSB signal thus obtained is further amplified and fed to the transmit mixer of the RF unit.

The transmit mixer is a double balanced type mixer with 2 MOS FETs. The local oscillator is VCO type (voltage controlled oscillator) whose output is controlled by the PLL circuit to minimize spurious during transmission. The SSB signal converted into the wanted transmit frequency is amplified by the transmit driver tube (12BY7A) before being fed to the two S2001A power amplifier tubes of the final stage.

They operate in class AB 1 because of low distortion amplification fo SSB signal.

The output signal is transmitted through a pi-network to the antenna.

RF NFB is applied from the output of final stage to the driver stage to further reduce the cross modulation distortion.

RECEIVER SECTION

The antenna signal passes through the RF ATT switch, where it is attenuated by about 20 dB as necessary, and is then amplified by the RF unit.

The amplified signal is fed to the buffer amplifier and mixed with VCO output in the balanced mixer with 2 MOS FETs to produce 8,830 kHz IF signal.

This signal is fed to the IF unit, passes through the noise blanker circuit and the crystal filter, and is finally amplified by the 3-stage IF amplifier, so that it is converted into AF signal by the ring detector.

The AF signal is applied to the AF-AVR unit where it is amplified to the level to drive the speaker. The frequency characteristic of the AF amplifier is automatically changed to suit CW or SSB operation by means of the MODE switch.

5.2 BOARD AND UNIT

IF BOARD (X48-1150-00)

The IF Board is very important for operation of transmitter and receiver. It is composed of the microphone amplifier, ring modulator, crystal filter, transmit-receive IF amplifier and the ring detector, in addition to the noise blanker circuit, AGC amplifier, S meter amplifier, speech processor and mo-

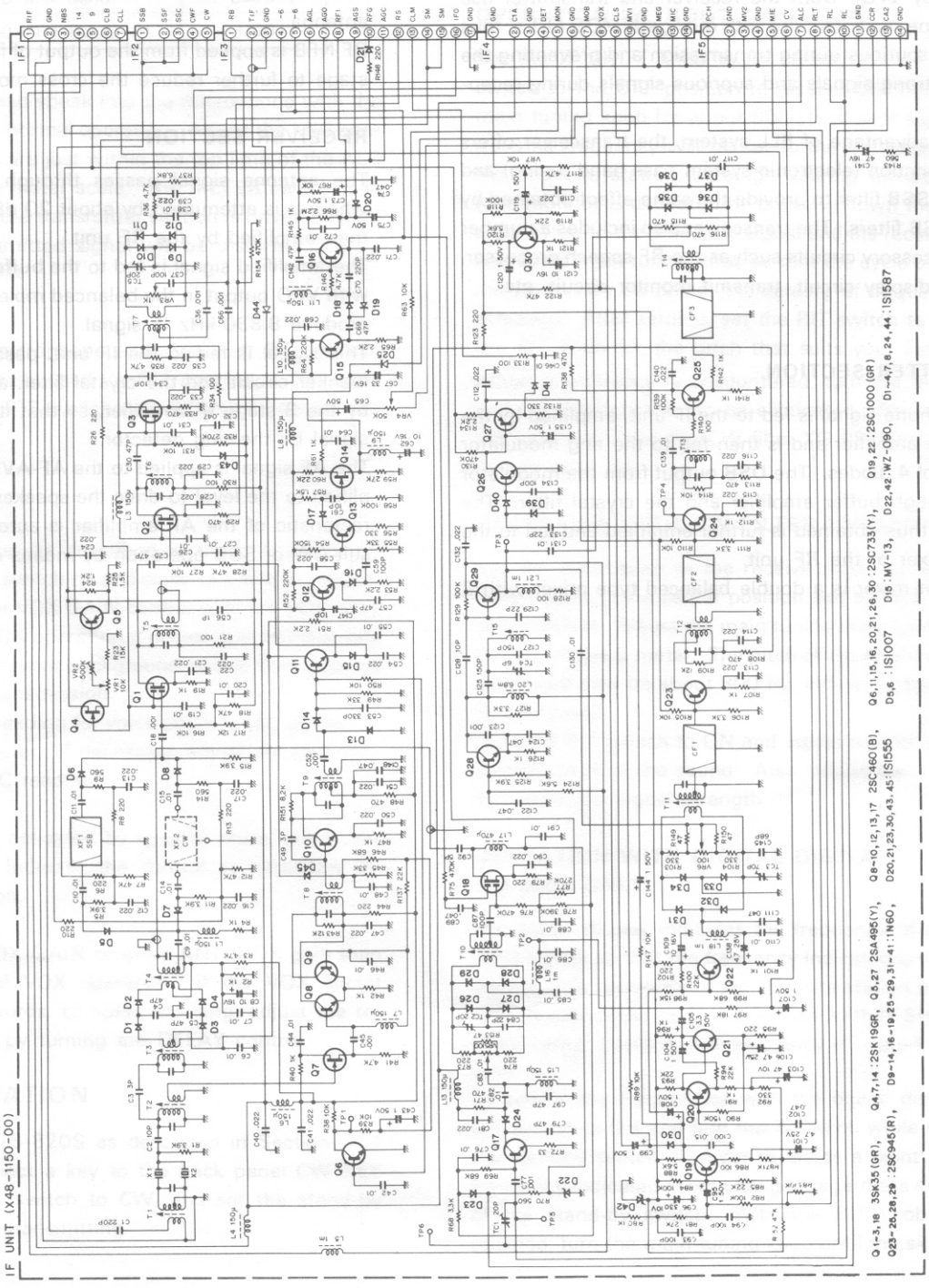


Fig. 12 IF Board

nitor circuit.

Crystal filters are self contained for SSB operation. CW filters (YG-88C) are available as optional accessories, for easy installation.

RF BOARD (X44-1150-00)

The RF Board holds the ALC amplifier circuit and the block bias circuit as well as the RF amplifier and mixer circuit for transmission and reception.

It also includes a coil pack unit for the tuning circuit.

COIL PACK BOARD (X44-1140-00)

Tuning coils for the individual bands and stages, band select rotary switch and variable capacitor are all arranged rationally in one unit. These parts function together with the RF Board.

VFO UNIT (X40-1110-00)

The PLL circuit is controlled by VFO signals, thus the frequency stability of TS-820S is virtually determined by the stability of VFO. The unit is composed of 2 FETs, 2 transistors and 3 diodes. Its oscillation frequency is set to 5.0 ~ 5.5 MHz.

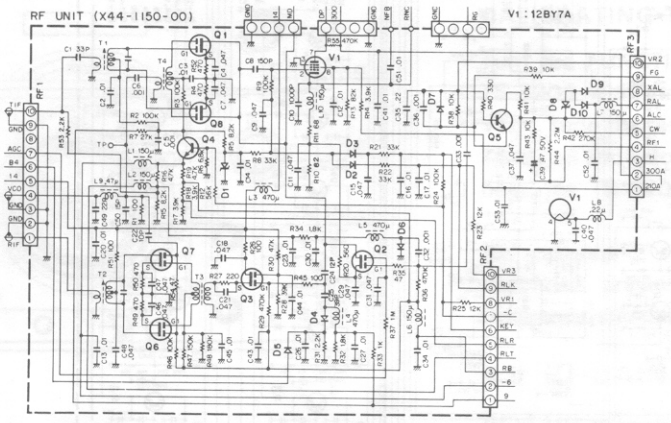


Fig. 13 RF Board

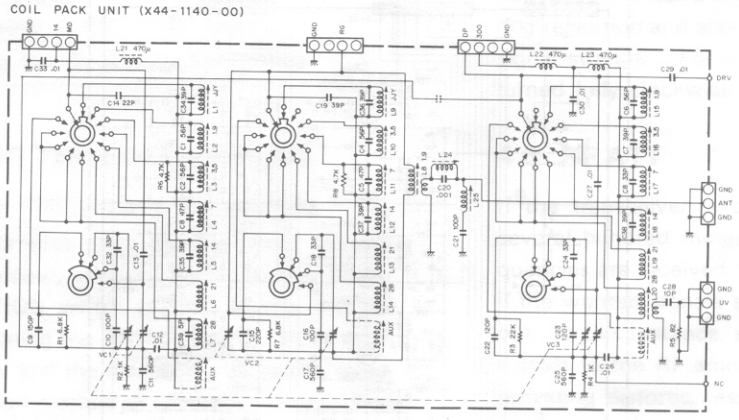


Fig. 14 Coil Pack Board

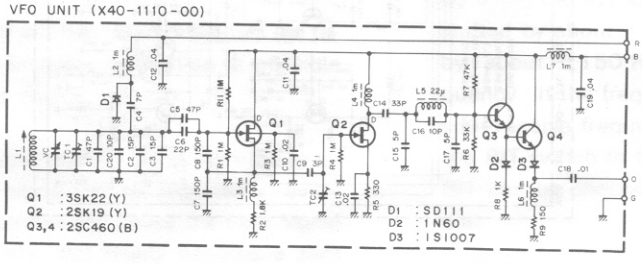


Fig. 15 VFO Unit

PLL Unit (X60-1010-00)

This unit is composed of the PD Board and the VCO Board to function as a local oscillator for the transmitter and the receiver. Stabilized oscillator output like that of the built-in VFO can be obtained for each band. The PD Board holds crystal oscillators for each band, 2 mixer circuits, waveform shaping circuit and phase comparator. It uses VFO as a

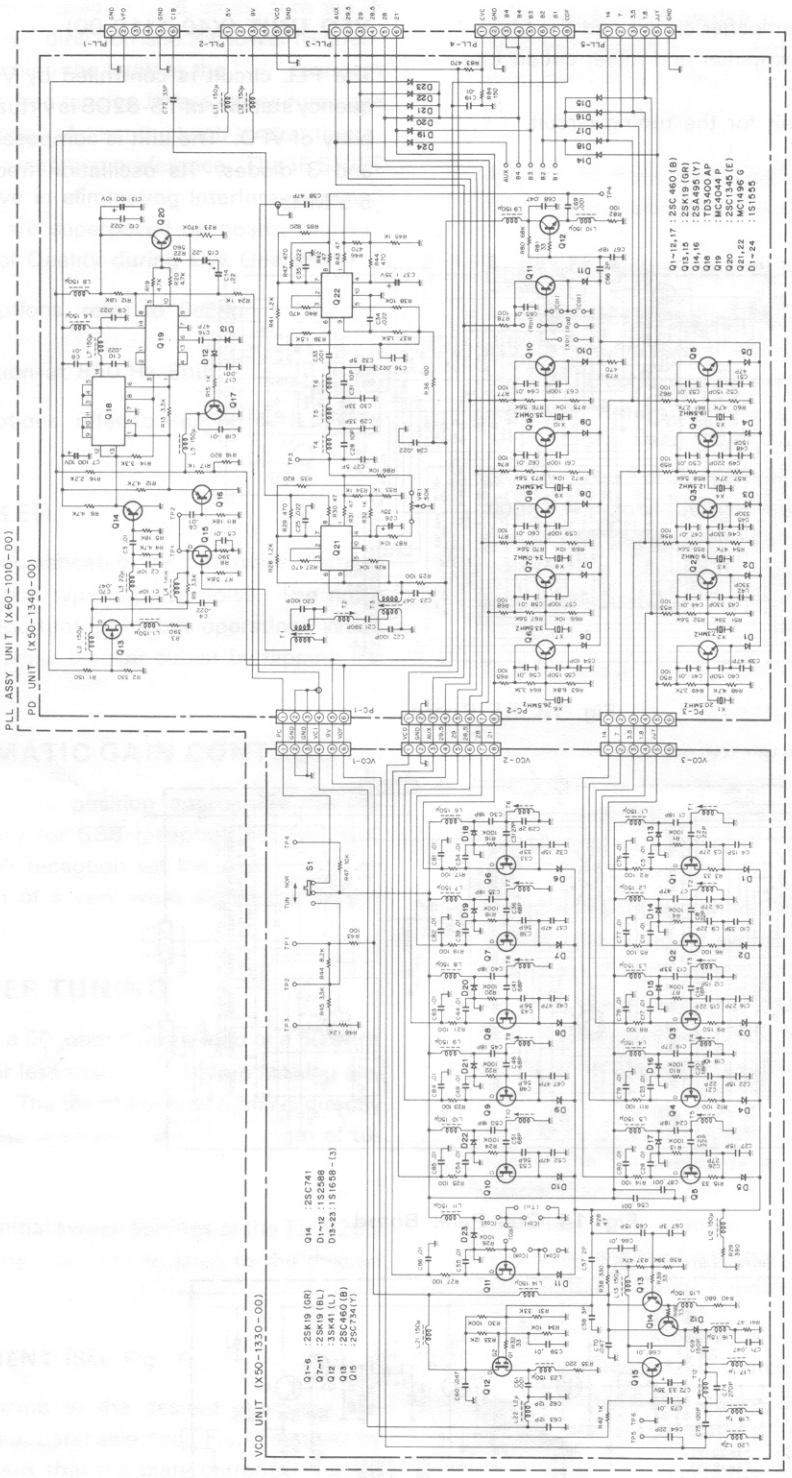


Fig. 16 PLL Unit

standard oscillator to produce a voltage to control VCO (voltage controlled oscillator). It also forms a full electronic IF shift loop using an external carrier signal. The VCO unit is composed of FET type oscillators for each band, buffer amplifier circuit, and the oscillator shut off circuit at the time of fault of the PLL circuit. The oscillator frequency is controlled by the control voltage from the PD Board. The bands of both units can be selected by means of the diode switches.

COUNTER ASS'Y UNIT (X60-1020-00) (TS-820S TYPE ONLY)

This unit is composed of the counter mixer board that produces operating frequencies by mixing the VCO output (local oscillator signal for the mixer) with carrier signal, and the counter board that counts the frequencies in digits. These units are housed in a rigid shielding case. Since the frequencies are read by synthesizing all the local oscillator signals, accurate operating frequencies are always counted under any operating conditions. The counter output is picked up as a signal to drive the indicating tubes and is fed to the display unit.

Counter Ass'y Unit

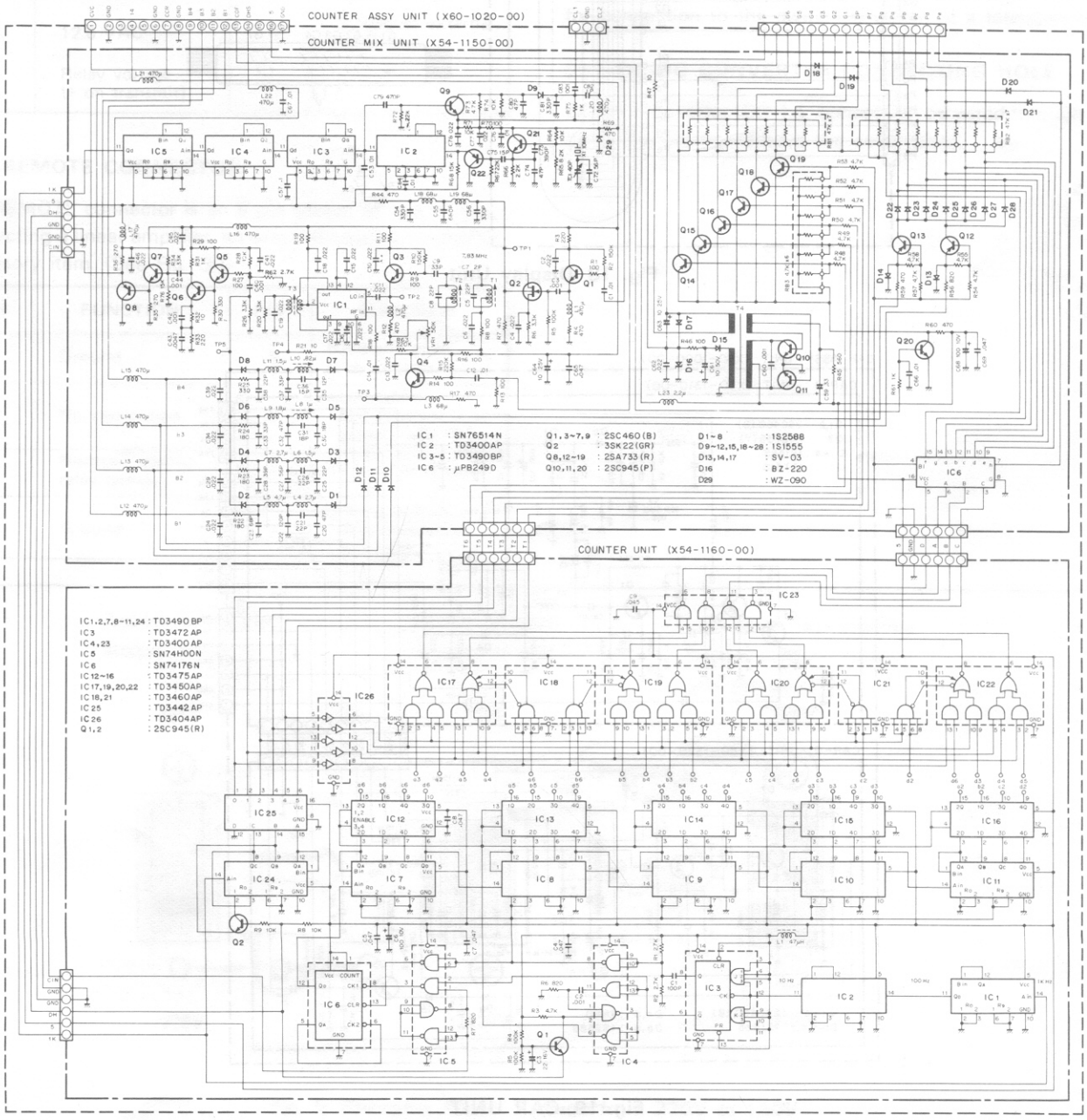


Fig. 17 Counter Ass'y Unit

DISPLAY UNIT (X54-1310-00) (TS-820S TYPE ONLY)

This unit uses a 6 digit fluorescent indicator to indicate operating frequencies counted by the counter unit. All the digits glow green to provide many hours of fatigueless operation.

CAR ASSY UNIT (X60-1000-00)

This is a crystal oscillator that functions as a carrier for the generator during transmission and as a BFO for ring detection during reception. The output is partly applied to the PLL Unit and the COUNTER UNIT.

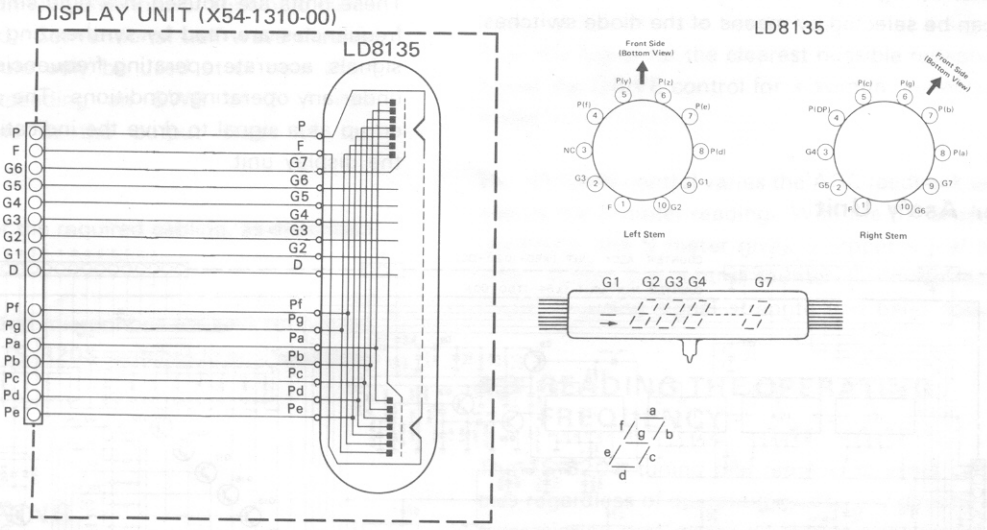


Fig. 18 Display Unit

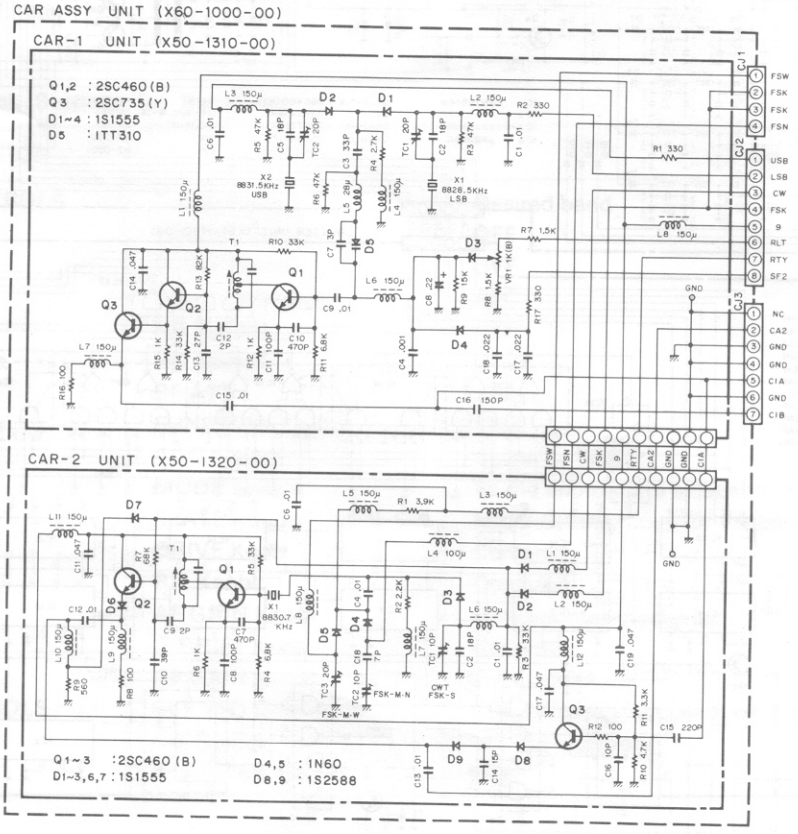


Fig. 19 CAR UNIT

AF-AVR BOARD (X49-1080-00)

This Board represents the final stage of the receiver circuit, holding an AF amplifier and a 9V power stabilizer. The frequency characteristic of the AF amplifier can be varied for CW and SSB operation.

FIX-VOX BOARD (X50-1350-00)

This Board incorporates the fixed channel oscillator, the VOX (voice control) circuit controls voice operated transmission, the side tone oscillator to monitor CW signals and the voltage generator circuit for the clock bias circuit (−6V).

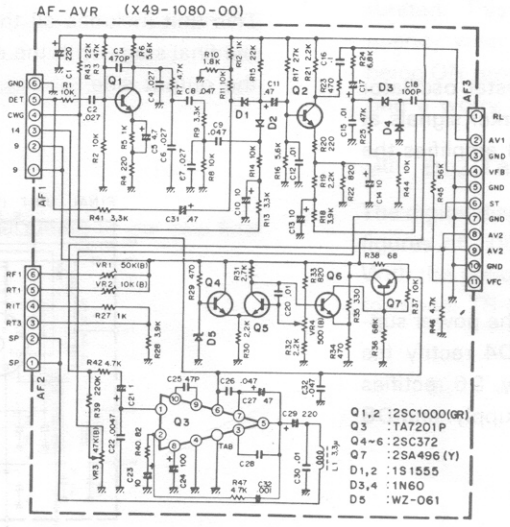


Fig. 20 AF-AVR Board

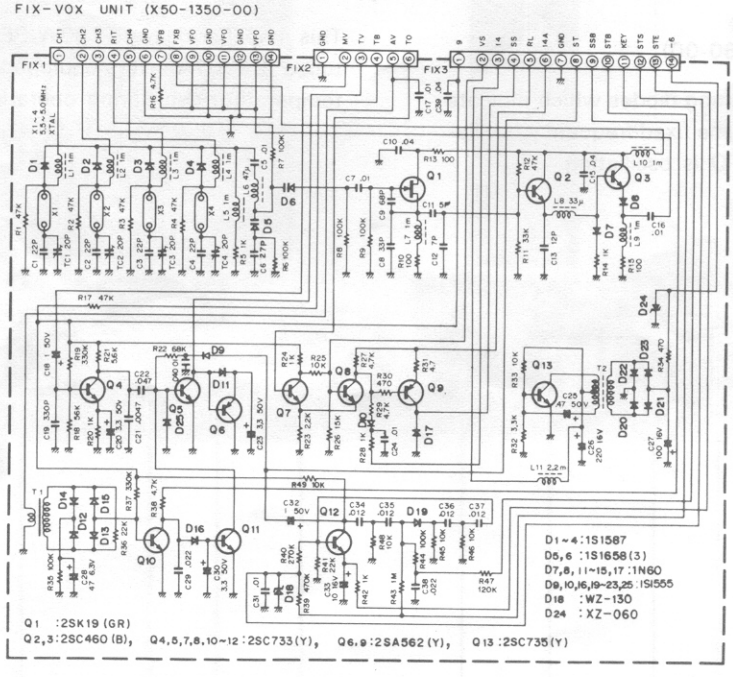


Fig. 21 FIX-VOX Board

VOX-VR BOARD (X54-1190-00)

Three variable resistors, VOX GAIN, ANTI VOX and DELAY, are directly mounted on a printed circuit board.

5V AVR BOARD (OPTION) (X43-1220-00)

This is a 5V power stabilizer used for the counter unit. It uses IC to provide rated voltage without making any adjustments.

MARKER BOARD (X50-1600-00)

The MARKER board holds the 2.5 MHz crystal oscillator (Q1) and a 1/100 divider (Q2) to produce marker signals at 25 kHz intervals to calibrate the TS-820. Q3 amplifies the calibrator signal.

RECTIFIER BOARD (X43-1090-02)

This board holds all of the diode rectifiers for the power supply section of the transceiver. D1 through D4 rectify the high voltage, D5 rectifies the 300 volt supply, D6 rectifies the 210 volt supply, D7 rectifies the 90 volt supply, and D8 through D11 rectify the 13.8 VDC supply.

HV (HIGH VOLTAGE) BOARD (X43-1110-00)

This voltage divider circuit supplies a high voltage metering signal for the HV meter reading and also a low voltage screen source used in the TUN mode of operation.

INDICATOR BOARD (X54-1180-00)

This circuit controls the light emitting diodes which indicate when the RIT circuit is on, when the fixed frequency oscillator is operating, or when the VFO is oscillating.

RELAY BOARD (X43-1190-00)

This unit holds the stand-by relay, a 5V power stabilizer to feed power to the PLL circuit, and smoothing capacitors to obtain low voltage DC power.
The relay of this unit is used to select DC signal for controlling block bias, cross channel operation, etc.

FINAL BOARD (X56-1200-00)

This unit includes all the circuits of the power amplifier of the final stage with the exception of the pi-network circuit at the output side.

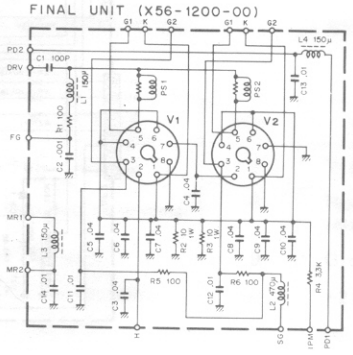


Fig. 22 FINAL Board

5.3 FINAL STAGE POWER AMPLIFIER

This amplifier delivers 200W PEP input by 2 transmit power tubes (S2001A). It is equipped with a cooling fan to avoid temperature rise during operation.

SECTION 6. MAINTENANCE AND ALIGNMENT

6.1 GENERAL INFORMATION

The TS-820S has been factory sligned and tested to specifications before delivery to the customer. Under normal circumstances the transceiver will be properly adjusted to operate in accordance with these operating instructions. In fact, the equipment owner can void the transceiver's warranty by attempting service or alignment without permission from the factory.

When operated properly, the transceiver can give years of service without requiring realignment. The information in this section, some general service procedures which can be accomplished without sophisticated test equipment.

REMOVING THE CABINET (See Fig. 23)

Figure 21 shows how to remove the TS-820S's cabinet. Remove the eight top cover screws and the nine bottom cover screws and lift away the panels. The speaker leads will still be attached to the chassis so be careful when removing the top cover. The leads can be unplugged, if necessary.

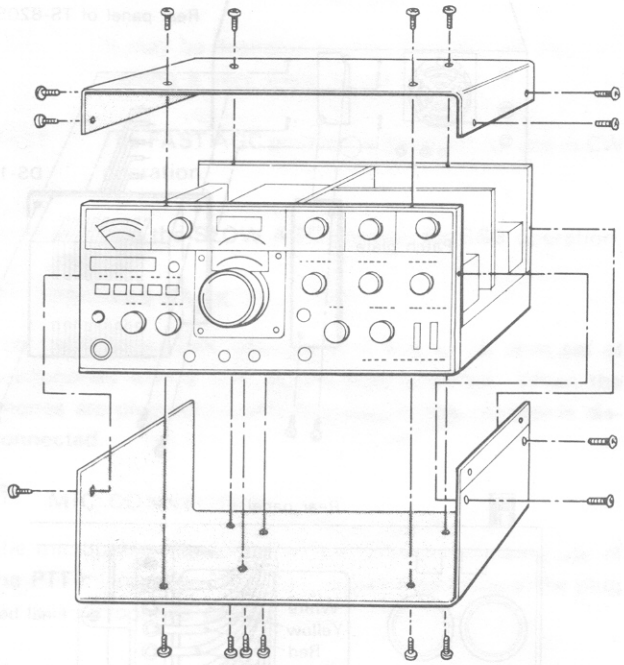


Fig. 23 Removing the Cabinet

SERVICE POSITION (See Fig. 24)

The TS-820S should be placed on its side, with the final section up, for any alignment or service. This position permits adequate ventilation for the final tubes as well as easy accessibility to the modules. Most of the described adjustments can be made without removing the boards from the transceiver.

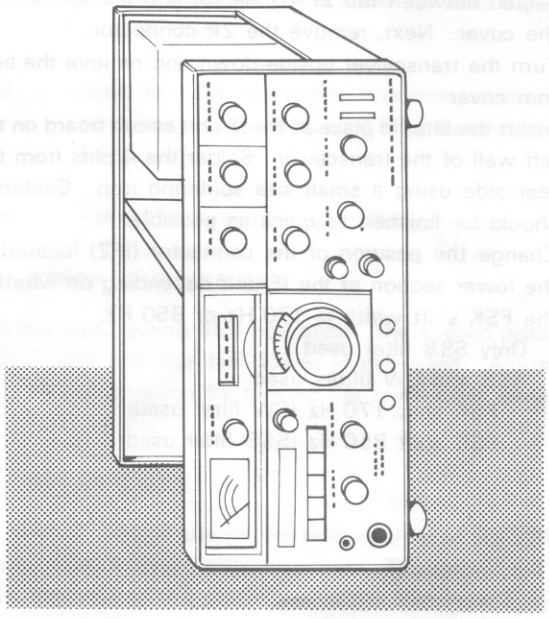


Fig. 24 Service Position

6.2 ACCESSORIES

CAUTION: BE SURE THE TRANSCEIVER IS UNPLUGGED AND TURNED OFF BEFORE REMOVING THE CASE.

INSTALLING THE CW FILTER (YG-88C)

(See Figure 25)

Install the filter unit according to the following procedures:

1. Remove the top cover of the transceiver using a screwdriver. Care should be used not to break the leads connected between the 2P connector and the speaker on the cover. Next, remove the 2P connector.
2. Turn the transceiver upside-down and remove the bottom cover.
3. Insert the filter in place at the IF unit circuit board on the left wall of the transceiver. Solder the 4 pins from the rear side using a small size soldering iron. Soldering should be finished as quick as possible.
4. Change the position of the connector (IF2) located at the lower section of the IF unit depending on whether the FSK shift width is 170 Hz or 850 Hz.

   Only SSB filter used..... A

   SSB and CW filters used:

   FSK shift 170 Hz (CW filter used) ..... B

   FSK shift 850 Hz (SSB filter used) C

NOTE:

1) If you are not interested in FSK operation, plug in the connector either to the "B" position or the "C" position.
2) To facilitage the installation of filter and setting of connector, remove the 3 screws holding the IF unit fixture to the chassis and then pull the unit upward.

5. Reconnect the 2P speaker connector in position, then replace the bottom cover and the top cover. The installation of the filter is now completed.

INSTALLING THE DC-DC CONVERTER (DS-1A)

1. Remove the patch plate located on the rear panel of TS-820S
2. Secure the DC-DC unit to the rear panel using the four tapping screws supplied with the unit.
3. Select the correct color coded lead from the DC-DC unit making sure that the color code corresponds to that of the lead connected to the DC-DC terminal board adjacent to the power transformer.
   Solder the lead onto the terminal board.

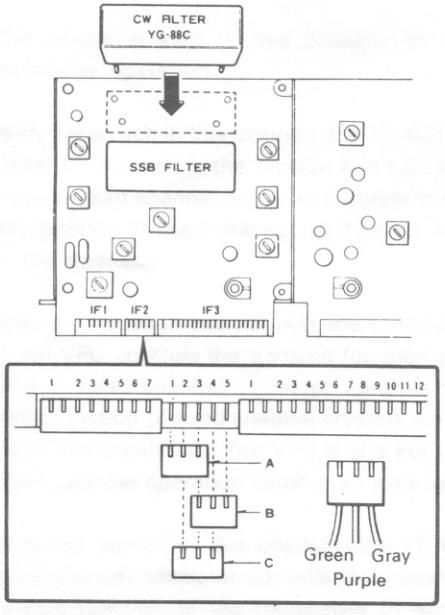


Fig. 25 Installing the CW Filter

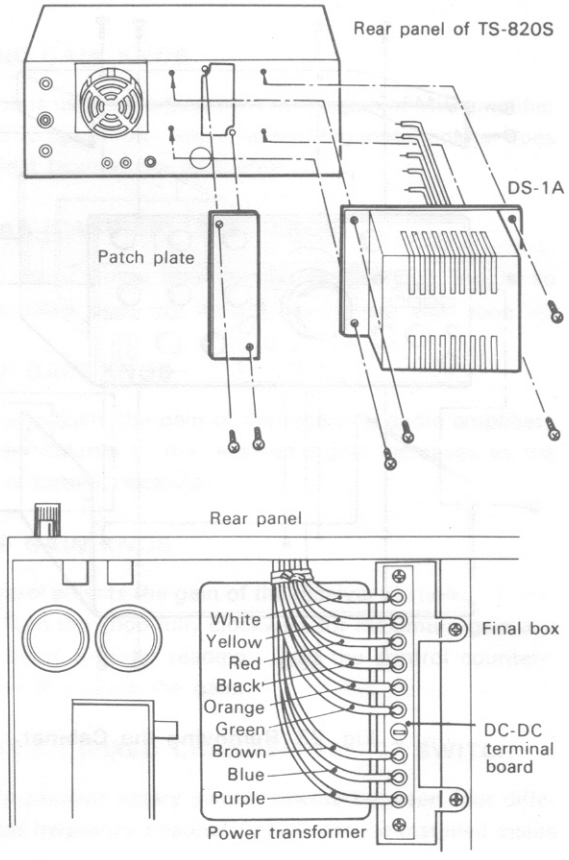


Fig. 26 Installing the DC-DC Converter

MOUNTING THE DIGITAL DISPLAY (DG-1A) (TS-820 TYPE ONLY)

(See Fig. 27)

DG-1 is provided with the following 3 units:

Display Unit
5V AVR Unit
Counter Ass'y Unit

1. Mount the above 3 units in place in the set using screws (Fig. 27(a))
2. Insert the connector and the wiring is completed.
3. Calibrate the standard frequency of the counter ass'y unit by WWV (refer to paragraph 6.3).
   For detailed method of mounting, refer to the instruction manual of DG-1A.

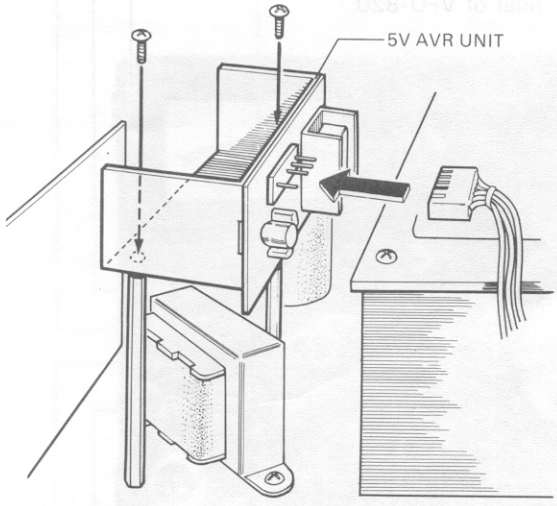


Fig. 27 (a)

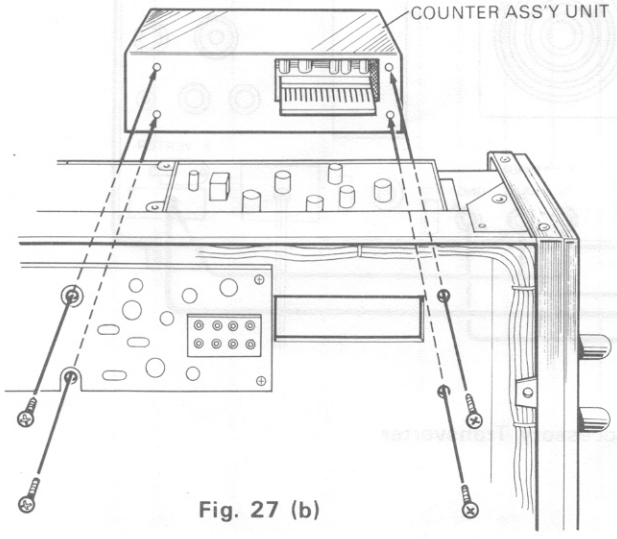


Fig. 27 (b)

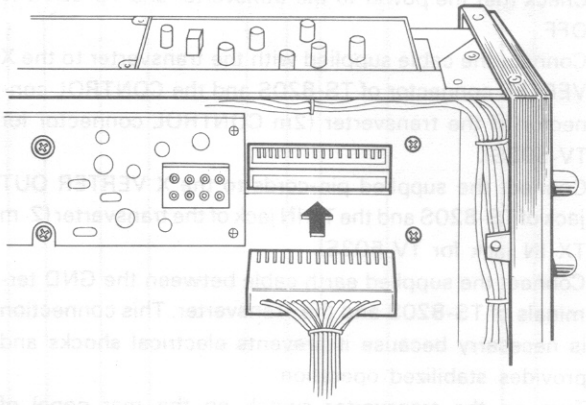


Fig. 27 (c)

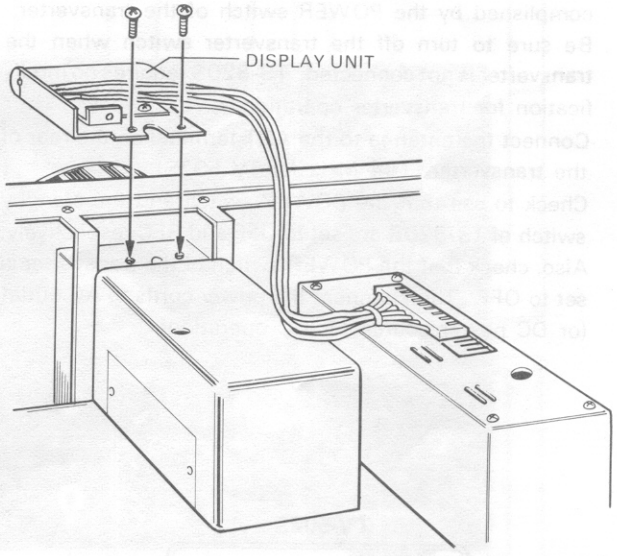


Fig. 27 (d)

TRANSVERTER (TV-502S)

To connect the transverter to TS-820S, proceed as follows:

1. Check that the power to the transverter and TS-820S is OFF.
2. Connect the cable supplied with the transverter to the X VERTER connector of TS-820S and the CONTROL connector of the transverter (2m CONTROL connector for TV-502S).
3. Connect the supplied pin-cords to the X VERTER OUT jack of TS-820S and the TX IN jack of the transverter (2 m TX IN jack for TV-502S).
4. Connect the supplied earth cable between the GND terminals of TS-820S and the Transverter. This connection is necesarry because it prevents electrical shocks and provides stabilized operation.
5. Turn on the transverter switch on the rear panel of TS-820S. The SG switch may be left in the ON position. Changeover between HF and VHF is automatically accomplished by the POWER switch of the transverter. Be sure to turn off the transverter switch when the transverter is not connected. TS-820S requires no modification for transverter operation.
6. Connect the antenna to the ANT terminal on the rear of the transverter (144 MHz for TV-502S).
7. Check to see that the POWER switch and the standby switch of TS-820S are set to OFF and REC respectively. Also, check that the POWER switch of the transverter is set to OFF. Then connect the power cords to AC outlet (or DC power source for DC operation).

CONNECTION OF VFO-820 (See Fig. 29)

Connect VFO-820 as shown in Fig. 29. This connection makes your transceiver operation more enjoyable. After connection, keep the 9-P MT plug removed from the EXT VFO connector of TS-820S in a proper place so that it is not lose. Connecting cord is supplied with VFO-820.

By manipulating the function switch of VFO-820, you can operate as if you are using 2 sets of transmitters and receivers. To calibrate the VFO frequency of TS-820S and that of VFO-820, proceed as follows:

1. Set TS-820S in the receive mode and then set the FUNCTION switch to CAL-RMT position.
2. The FUNCTION switch of VFO-820 may be set in any position.
3. Tune the frequencies of TS-820S and VFO-820 so that a beat is generated. When they are tuned for zero beat, the frequencies of both units are perfectly calibrated. For operation of VFO-820, refer to the instruction manual of VFO-820.

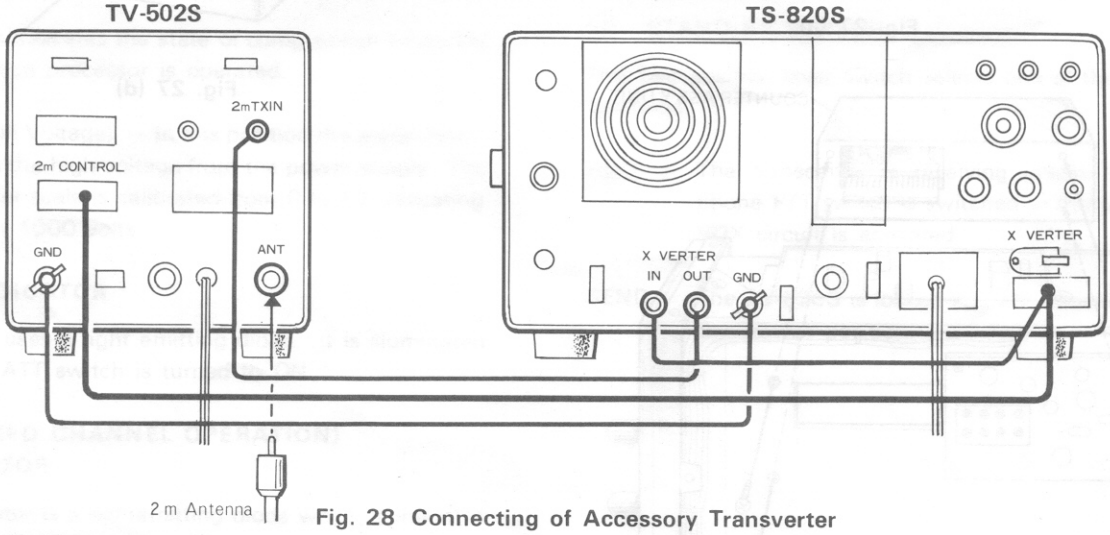


Fig. 28 Connecting of Accessory Transverter

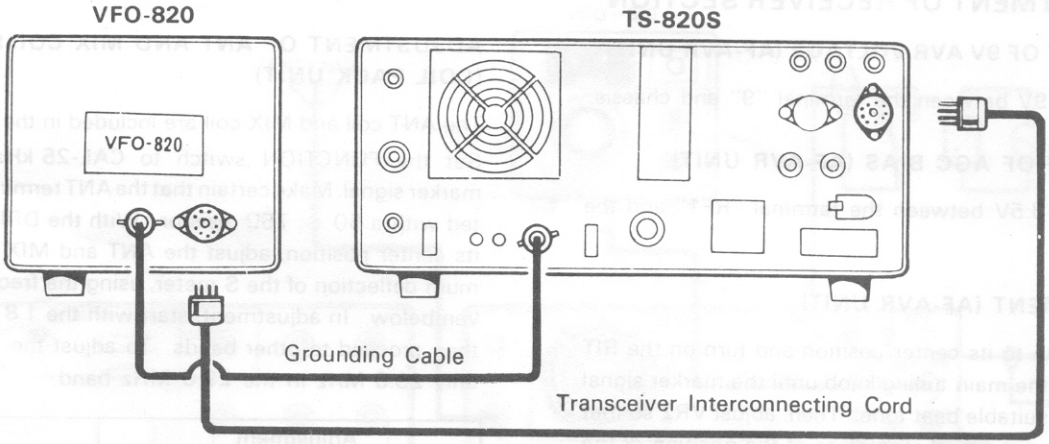


Fig. 29 Connection of Accessory Remote VFO

REMOTE CONNECTIONS

Fig. 30 shows the REMOTE connector. This 8-pin plug can be used for attaching linear amplifiers, or other external accessories to the transceiver.

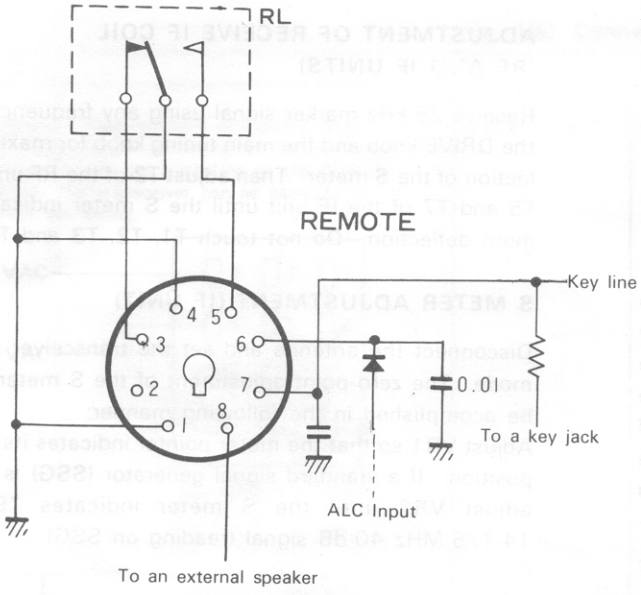


Fig. 30 Remote Connector

EXTENSION FEET

The TS-820S is provided with two extra feet which can be used to raise the front panel of the transceiver. In some operating positions the tilt makes it easier to read the dial and meter. Fig. 31 shows how to install the feet.

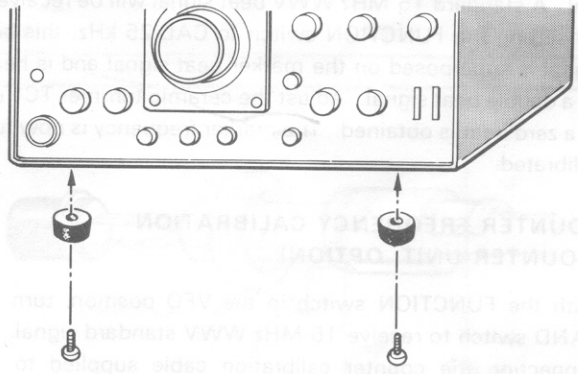


Fig. 31. Attaching the Extension Feet

FIXED CHANNEL CRYSTAL INSTALLATION

Section 4.15 describes fixed channel operation with the TS-820S. To install the accessory crystals, reemove the transceivers bottom cover and locate the FIX-VOX board side the power transformer.

Insert the crystal in the desired channel position (the positions are labeled on bottom of the case) and use the appropriate trimmer (TC1 through TC4) to net the crystal. The CAL-FIX feature of the TS-820S can be used to net the crystals as described in Section 4.4.

6.3 ADJUSTMENT OF RECEIVER SECTION

ADJUSTMENT OF 9V AVR VOLTAGE (AF-AVR UNIT)

Adjust VR4 for 9V between the terminal "9" and chassis.

ADJUSTMENT OF AGC BIAS (AF-AVR UNIT)

Adjust VR1 for 3.5V between the terminal "RF1" and the chassis.

RIT ADJUSTMENT (AF-AVR UNIT)

Set the RIT knob to its center position and turn on the RIT switch. Rotate the main tuning knob until the marker signal can be heard in suitable beat tone. Then, adjust VR2 so that the beat tone is not varied regardless of the position of the RIT switch.

MARKER FREQUENCY CALIBRATION (MARKER UNIT)

The marker frequency is factory adjusted prior to shipment. However, if it is deviated after a long period of use of the set, it must be calibrated accurately. TS-820S is designed to receive WWV signals so that the marker frequency can be calibrated precisely.
Set the BAND switch on the front to WWV and turn the main tuning knob until it is aligned with the "0" on the sub dial. A standard 15 MHz WWV beat signal will be received. By setting the FUNCTION switch to CAL-25 kHz, this beat signal is superposed on the marker beat signal and is heard as a double beat signal. Adjust the ceramic trimmer TC1 until a zero beat is obtained. The marker frequency is now fully calibrated.

COUNTER FREQUENCY CALIBRATION (COUNTER UNIT, OPTION)

With the FUNCTION switch in the VFO position, turn the BAND switch to receive 15 MHz WWV standard signal. By connecting the counter calibration cable supplied to the counter unit and the X VERTER IN jack on the rear panel, the WWV beat signal is superposed on the higher harmonics of the standard signal of the counter and is heard as a double beat signal. Adjust the trimmer of the counter unit to obtain a zero beat. By so doing, the frequency indicated on the digital display is accurately calibrated. After the calibration, disconnect the counter calibration cable.

ADJUSTMENT OF ANT AND MIX COILS (COIL PACK UNIT)

The ANT coil and MIX coil are included in the coil pack unit.
Set the FUNCTION switch to CAL-25 kHz to receive a marker signal. Make certain that the ANT terminals are shorted ted with a 50 ~ 75Ω resistor. With the DRIVE knob set to its center position, adjust the ANT and MIX coils for maximum deflection of the S meter, using the frequency table given below. In adjustment, start with the 1.8 MHz band and then proceed to other bands. To adjust the 10m band, use only 29.0 MHz in the 29.0 MHz band.

BAND	Adjustment Frequency	ANT Coil	MIX Coil	DRIVE coil
1.8	1.90 MHz	L8	L2	L15
3.5	3.75 MHz	L10	L3	L16
7	7.15 MHz	L11	L4	L17
14	14.175 MHz	L12	L5	L18
21	21.225 MHz	L13	L6	L19
29.0	29.00 MHz	L14	L7	L20
WWV	15.00 MHz	L9	L1	

ADJUSTMENT OF RECEIVE IF COIL (RF AND IF UNITS)

Receive 25 kHz marker signal using any frequency. Adjust the DRIVE knob and the main tuning knob for maximum deflection of the S meter. Then adjust T2 of the RF unit and T4, T5 and T7 of the IF unit until the S meter indicates maximum deflection. Do not touch T1, T2, T3 and T6.

S METER ADJUSTMENT (IF UNIT)

Disconnect the antenna and set the transceiver in receive mode. The zero-point adjustment of the S meter can now be acomplished in the following manner:
Adjust VR1 so that the meter pointer indicates its minimum position. If a standard signal generator (SSG) is available, adjust VR2 until the S meter indicates "9", using 14.175 MHz 40 dB signal (reading on SSG)

6.4 ADJUSTMENT OF TRANSMITTER SECTION

ADJUSTMENT OF TRANSMIT DRIVE COIL (COIL PACK UNIT)

The drive coil is built in the coil pack unit. Set the SG switch on the rear panel to OFF and the DRIVE knob to its center position. Then, set the METER switch to ALC and the MODE switch to CW or TUN position.
With the standby switch in the SEND position, adjust the drive coils for maximum ALC deflection for each band using the same frequency as for the adjustment of ANT and MIX coils.
During the adjustment, turn the CAR knob just enough to swing the meter (ALC). This adjustment can be started with any band.

ADJUSTMENT OF TRANSMIT IF COIL (IF AND RF UNITS)

Using any frequency. set the transceiver in transmit mode at CW or TUN position. Adjust T5 of the IF unit and T1 of the RF unit until the meter (ALC) indicates maximum deflection.

CARRIER BALANCE ADJUSTMENT (IF UNIT)

(See Fig. 31)

With a dummy load connected to the ANT terminals, adjust for the maximum output using 14.175 MHz frequency. Set the transceiver in LSB mode and turn the RF VOLT knob on the rear panel for maximum sensitivity. The pointer of the RF meter will deflect if the carrier is unbalanced. In this case, be sure to turn the MIC knob to the minimum position.
To balance the carrier, adjust the trimmer TC2 and the semi-fixed resistor VR5 alternately until the meter pointer indicates a minimum position. Change the mode to USB and if the pointer deflects, then readjust so that the pointer deflects the same amount for both LSB and USB.

NEUTRALIZING THE FINAL STAGE

Adjust the drive and final stages completely using 21.3 MHz, with a dummy load connected.
Set the SG switch to OFF and measure the output at the ANT terminals (shorted with dummy load) with a high sensitivity RF voltmeter or a tester having a rectifying diode such as 1N60. Then turn the nuetralizing variable capacitor (TC1 viewed through the adjusting hole in the upper panel of the final box) for minimum output. Normally, it is unnecessary to remove the shielding case for this adjustment, but be sure to use a insulated screwdriver. Use of a non-insulated screwdriver will result in incorrect adjustment and also cause electric shocks.

ADJUSTMENT OF SIDE TONE LEVEL (AF-AVR UNIT)

Adjust VR3 to your desired level.

ADJUSTMENT OF MONITOR LEVEL (IF UNIT)

Adjust VR4 to your desired level.

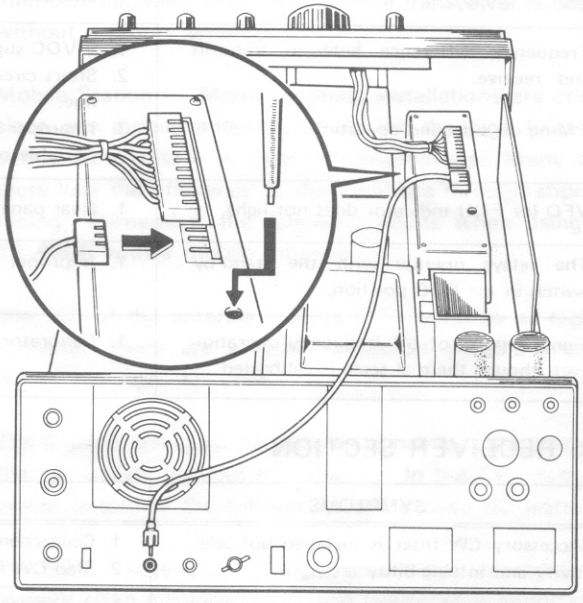


Fig. 31 Counter Frquency Calibration

SECTION 7. TROUBLESHOOTING

7.1 GENERAL INFORMATION

The problems described in this table are failures caused in general by improper operation or connection of the transceiver, not by defective components. There is a separate service manual for repair of the TS-820S.

7.2 TRANSMITTER AND RECEIVER CIRCUITS

SYMPTOMS	CAUSE	REMEDY
Pilot lights do not light and there is no receiver noise when the POWER switch is turned on.	1. Bad power cable or connections. 2. Blown power supply fuse. 3. Wrong polarity connection for DC operation.	1. Check cables and connections. 2. Replace the fuse. 3. Check for a negative ground power connection.
Frequency difference between transmit and receive. FMing on sideband operation.	1. 9 VDC supply not adjusted. 2. Short circuit in 9 volt power supply or line. 3. Improper battery voltage in mobile or portable operation.	1. See Section 6.3. 2. Check the 9 volt supply. 3. Check battery or alternator voltage.
VFO (or FIX) indicator does not light.	1. Rear panel VFO plug not inserted.	1. Insert the jumpered plug.
The relays operate with the stand-by switch in the REC position.	1. Improper microphone connection.	1. Require the microphone connector.
Signal reports of off frequency operation even though the dial scale is calibrated.	1. Calibrator requires alignment.	1. See Secton 6.3

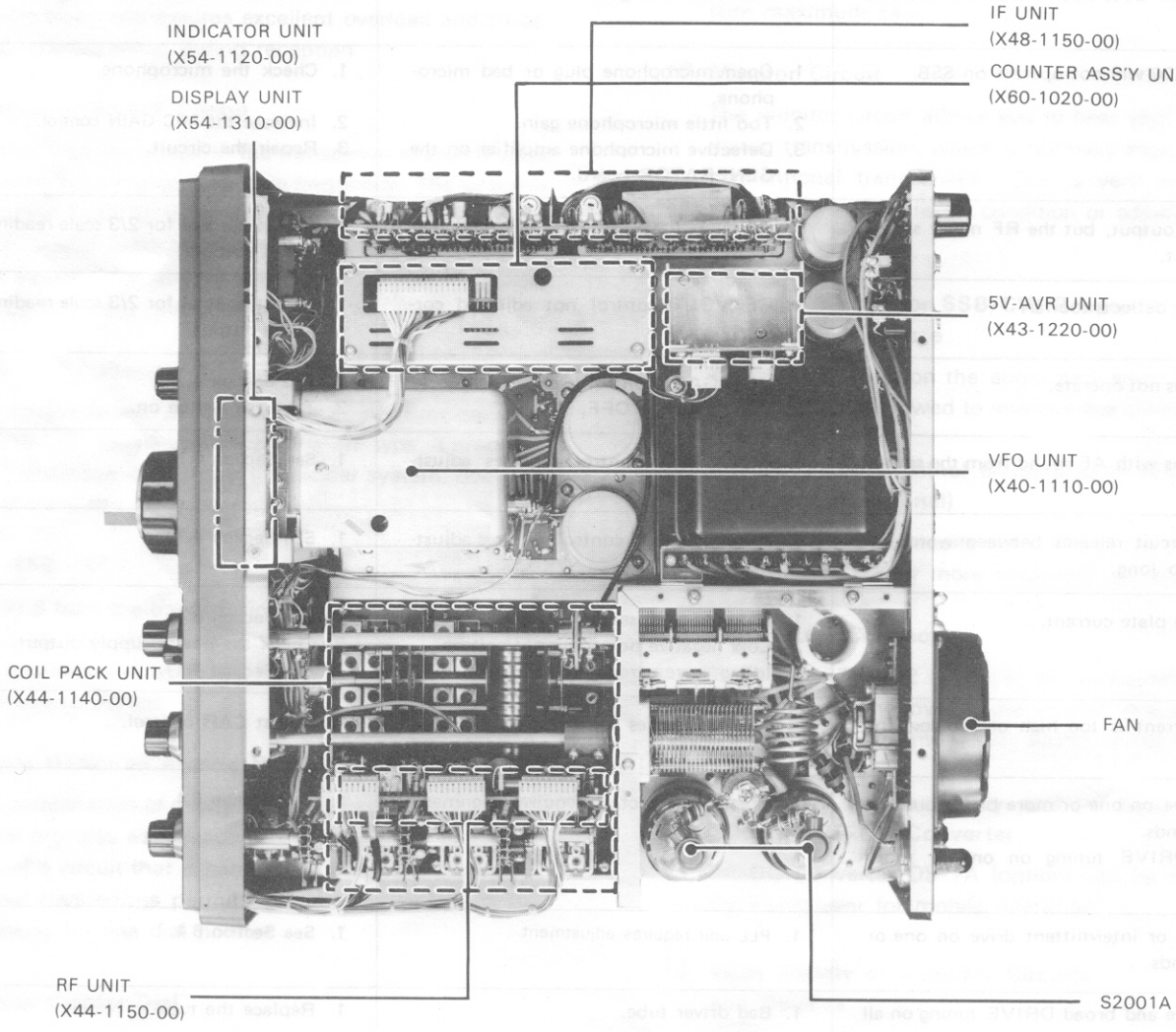
7.3 RECEIVER SECTION

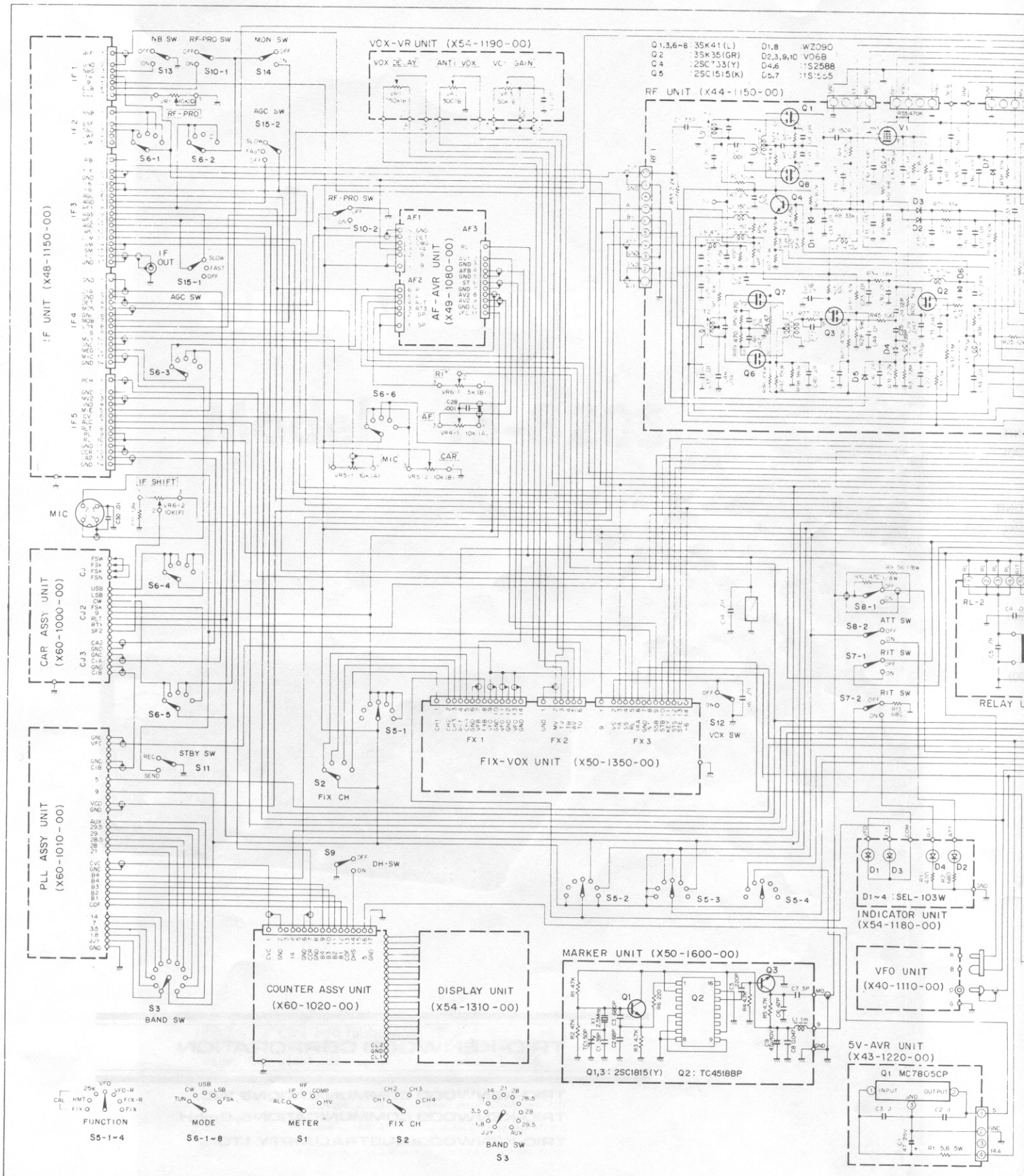
SYMPTOMS	CAUSE	REMEDY
Accessory CW filter is installed but selectivity and intelligibility are poor.	1. Connection of IF board not moved to CW. 2. Bad CW filter.	1. See Section 6.2 2. Replace the CW filter.
An antenna is connected but no signals are heard.	1. Inoperative VFO or FC oscillator. 2. Microphone PTT switch (or stand-by switch) is in the transmit position. 3. Transverter switch is ON.	1. Insert the shunt plug into back panel. 2. Release the PTT switch. 3. Turn the switch OFF.
An antenna is connected and the calibrator signal is received, but no signals are heard.	1. Bad T/R relay.	1. Replace the relay.
One or more bands are operating but some are not.	1. The PLL unit is not operating on the defective band. 2. The antenna coil of the defective band requires alignment.	1. Repair the PLL unit. 2. See Section 6.3.
S-meter deflects without a received signal.	1. IF board is out of adjustment. 2. Low AC line voltage.	1. See Section 6.3 2. Use a step-up transformer to raise the line voltage.
S-meter reads too high or too low.	1. IF board is out of adjustment. 2. RF gain control closed causing low sensitivity.	1. See Section 6.3. 2. Open RF GAIN control.
Lack of sensitivity on one or more bands.	1. Receiver section requires realignment.	1. See Section 6.3.
The RIT control is at zero with the RIT circuit on, but the receive and transmit frequencies are different.	1. The RIT control is out of adjustment.	1. See Section 6.3.
RIT control inoperative.	1. RIT circuit off.	1. Push RIT button.
SSB signal unintelligible.	1. MODE switch is set to wrong sideband.	1. Turn MODE switch to correct sideband.
SSB received signal is extremely high cut (or low cut).	1. IF SHIFT is out of adjustment	1. Set it in the center (in the position of click)

7.4 TRANSMITTER SECTION

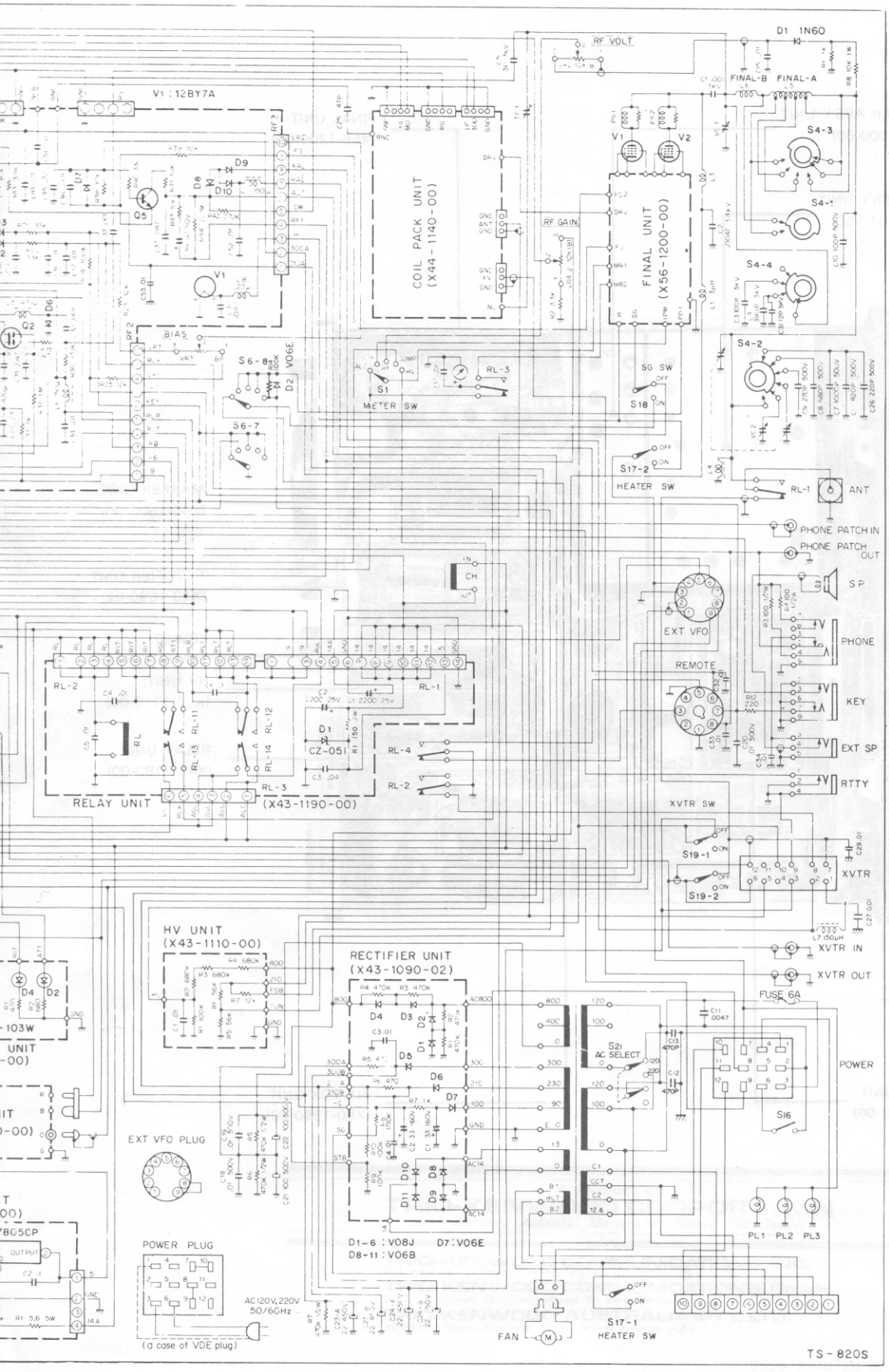
SYMPTOMS	CAUSE	REMEDY
RF meter deflects with no output (no plate current.)	1. No high voltage (+800v) on the final tubes. 2. Bad final tubes. 3. SG switch is turned off.	1. Check the HV power supply. 2. Replace the tubes. 3. Slide the switch up.
ALC meter does not deflect and there is output.	1. Too little MIC gain.	1. Increase the MIC GAIN control.
The TS-820 will not operate on SSB.	1. Open microphone plug or bad microphone. 2. Too little microphone gain. 3. Defective microphone amplifier on the GENERATOR board.	1. Check the microphone. 2. Increase the MIC GAIN control. 3. Repair the circuit.
There is output, but the RF meter shows no output.	1. RF VOLT control not adjusted correctly.	1. Adjust control for 2/3 scale reading at full output.
RF meter deflects too far.	1. RF VOLT control not adjusted correctly.	1. Adjust control for 2/3 scale reading at full output.
VOX does not operate.	1. VOX GAIN control is closed. 2. VOX switch is OFF.	1. See Section 4.12. 2. Turn the switch on.
VOX trips with AF sound from the speaker.	1. ANTI VOX control requires adjustment.	1. See Section 4.12.
VOX circuit releases between words or holds too long.	1. VOX time hold control requires adjustment.	1. See Section 4.12.
Excessive plate current.	1. Detuned final section. 2. Low negative power supply voltage. 3. Idling current requires adjustment.	1. See Section 6.4 2. Check the power supply output. 3. See Section 4.11
Plate current is too high or too low for CW.	1. Carrier requires adjustment.	1. Adjust CAR control.
Low drive on one or more bands but not on all bands. Broad DRIVE tuning on one or more bands.	1. Transmitter section requires alignment.	1. See Section 6.4.
No drive or intermittent drive on one or more bands.	1. PLL unit requires adjustment.	1. See Section 6.4.
Low drive and broad DRIVE tuning on all bands.	1. Bad driver tube.	1. Replace the tube.
Signal reports of carrier.	1. Carrier requires balancing.	1. See Section 6.4
Signal reports of distortion.	1. Too much microphone gain.	1. Reduce MIC control.
Plate current is too low. Tuning becomes very broad. Idling current increases.	1. Bad final tubes.	1. Replace the tubes.
Every time either of the final tubes is replace, the TS-820S requires neutralization.		1. See Section 6.4

TOP VIEW OF THE TS-820S

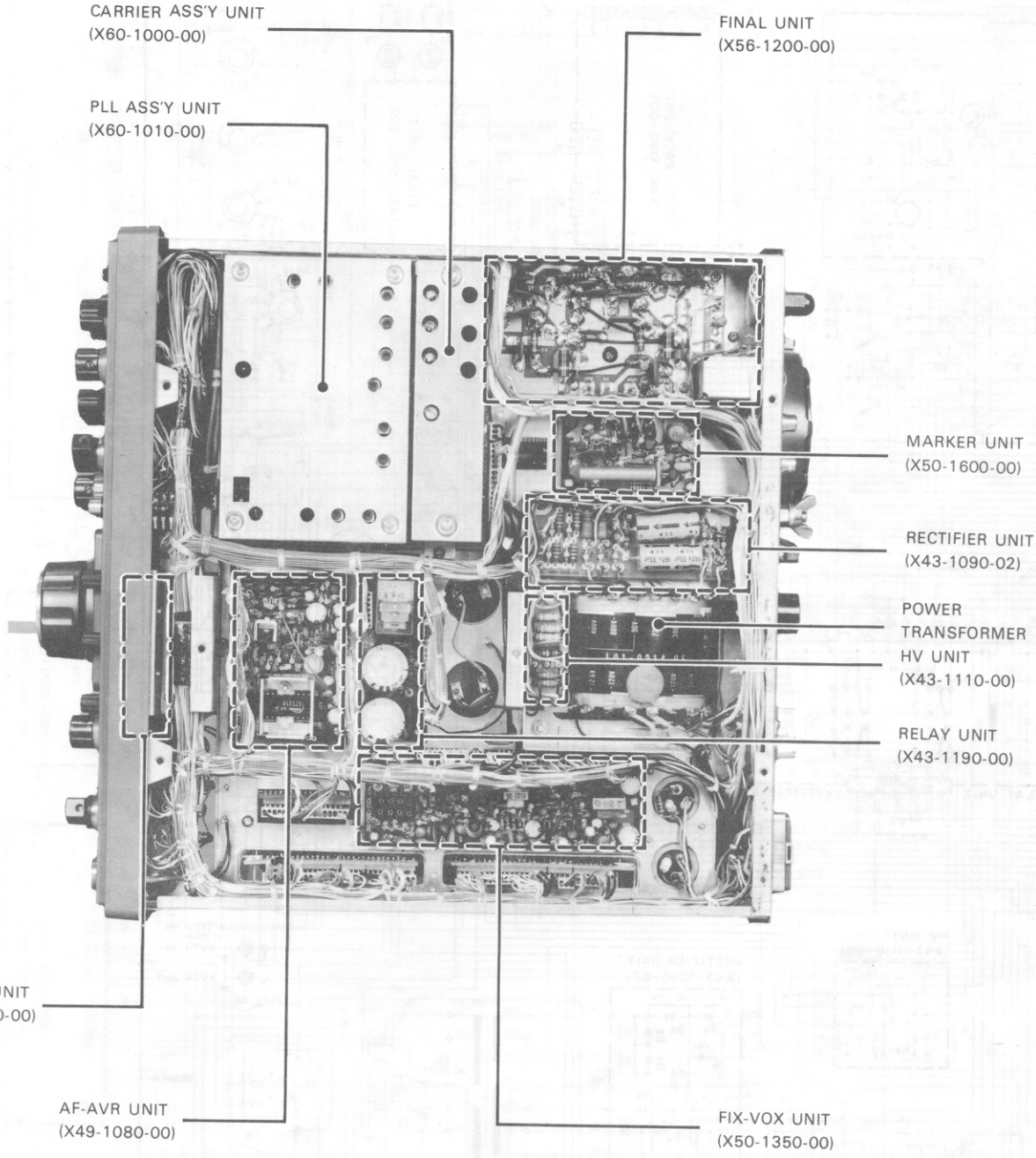



IF UNIT (X48-1150-00)
VOX-VR UNIT (X54-1190-00)
RF UNIT (X44-1150-00)
AF-AVR UNIT (X49-1080-00)
CAR ASSY UNIT (X60-1000-00)
PLL ASSY UNIT (X60-1010-00)
FIX-VOX UNIT (X50-1350-00)
COUNTER ASSY UNIT (X60-1020-00)
DISPLAY UNIT (X54-1310-00)
MARKER UNIT (X50-1600-00)
INDICATOR UNIT (X54-1180-00)
VFO UNIT (X40-1110-00)
5V-AVR UNIT (X43-1220-00)
RELAY U
Q1,3,6~8 : 3SK41(L)
Q2 : 3SK35(GR)
Q4 : 2SC733(Y)
Q5 : 2SC1515(K)
D1,8 : WZ090
D2,3,9,10 : V06B
D4,6 : 1S2588
D5,7 : 1S1555
D1~4 : SEL-103W
Q1,3 : 2SC1815(Y) Q2 : TC4518BP
Q1 MC7805CP
NB SW
RF-PRO SW
MON SW
AGC SW
IF SHIFT
MIC
STBY SW
DH SW
FIX CH
VOX SW
ATT SW
RIT SW
BAND SW
FUNCTION
S5-1~4
MODE
S6-1~8
METER
S1
FIX CH
S2
BAND SW
S3

TIC DIAGRAM


V1 : 12BY7A
RF VOLT
D1 1N60
FINAL-B
FINAL-A
COIL PACK UNIT
(X44-1140-00)
FINAL UNIT
(X56-1200-00)
RF GAIN
BIAS
METER SW
SG SW
HEATER SW
RL-1
ANT
PHONE PATCH IN
PHONE PATCH OUT
SP
PHONE
KEY
EXT SP
RTTY
EXT VFO
REMOTE
XVTR SW
XVTR
XVTR IN
XVTR OUT
FUSE 6A
POWER
RELAY UNIT
(X43-1190-00)
HV UNIT
(X43-1110-00)
RECTIFIER UNIT
(X43-1090-02)
EXT VFO PLUG
POWER PLUG
AC120V,220V
50/60Hz
(a case of VDE plug)
FAN
D1~6 : V08J
D8~11 : V06B
D7 : V06E
TS-820S

BOTTOM VIEW OF THE TS-820S



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